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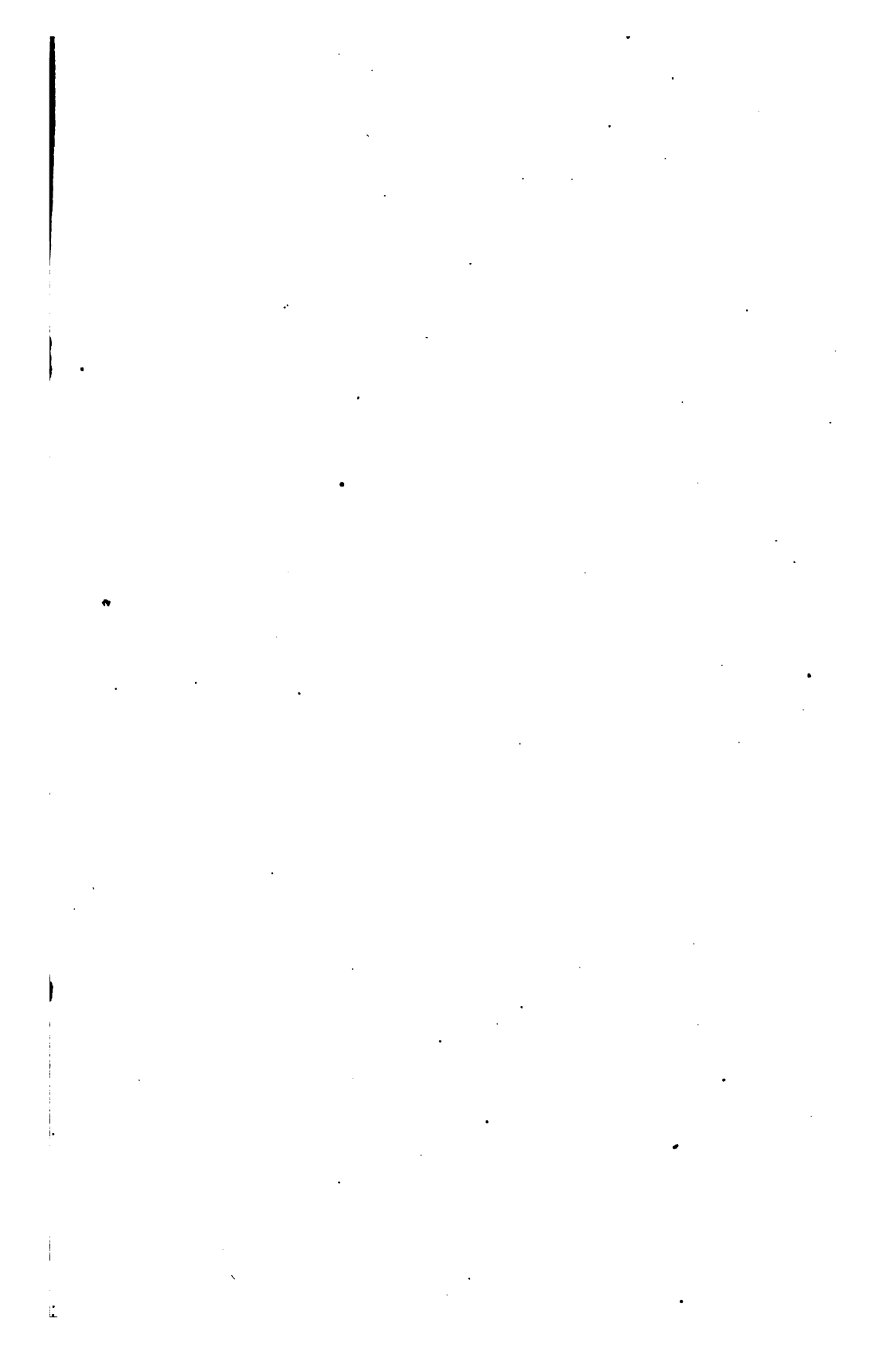
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No. 34.
U. S. -
HYDROGRAPHIC OFFICE BUREAU OF NAVIGATION

SAILING DIRECTIONS
FOR
THE ENGLISH CHANNEL.

PART I.
SOUTH COAST OF ENGLAND.

COMPILED AT THE
— *Bureau of navigation* —
UNITED STATES HYDROGRAPHIC OFFICE.

PUBLISHED BY ORDER OF THE BUREAU OF NAVIGATION, NAVY
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Gift of Commodore
R. H. Hyman, U. S. N.
of Washington,

ADVERTISEMENT.

These directions have been compiled in this office mainly from official publications of the British admiralty. Imray's Sailing Directions; The Pilots' Handbook, by Staff Commander J. W. King, R. N.; A Paper on the Tidal Streams of the English Channel and North Sea, by Captain F. W. Beechey, R. N.; and other reliable sources of information have been consulted.

R. H. W.

U. S. HYDROGRAPHIC OFFICE, *February* 9, 1872.

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NOTE.

The courses and bearings given in this work are magnetic, unless otherwise stated.

Distances are expressed in nautical miles, which may be assumed to be equal to minutes of latitude. The cable-length is one-tenth of a mile, or a little more than one hundred fathoms.

The rise of tide is its height above mean low-water springs, the level to which soundings are also referred.

According to the system adopted in all channels under the direction of Trinity House, England, the starboard side, entering, is marked by black or red buoys only, and the port side by black or red buoys checkered or striped with white. Middle grounds are marked by black or red buoys with white bands or horizontal stripes. Only one color, either black or red, is used in the same channel. When beacons are placed on buoys, the starboard side, entering, is distinguished by globes, the port side by cages, and middle grounds by triangles or diamonds. Wrecks are usually marked by green nun-buoys with the word "wreck" painted on them.

CHAPTER I.

GENERAL DIRECTIONS FOR THE ENTRANCE AND NAVIGATION OF THE ENGLISH CHANNEL.

On approaching the entrance of the English Channel every effort should be made to ascertain the ship's true position, and when from the unfavorable state of the weather this is not known with certainty, the utmost caution and watchfulness are requisite in making the land. Under any circumstances the lead should be frequently used, but at night, and during a fog, constant sounding is of the greatest importance, especially as, from the irregularities of the bottom, a single cast may at times tend to mislead rather than be of service. A judicious allowance should be made for the imperfections of the compass, and possible effect of currents, and all precautions taken which are usual with prudent navigators when approaching the land. It is generally from neglect of these precautions that ships have overrun their reckoning, and become involved among the dangers on the coast of France, far from their supposed position.

Bound into the English Channel under favorable circumstances, it is generally advisable to make the land at Lizard Head, or Start Point, and run up along the English coast. The strong tides and dangers on the coast of France are thus avoided, and should a sudden shift of wind occur a port of refuge will not be far distant. Entering the Channel.

Coming from the southward with the wind between S. E. and S. W., Ouessant may be made. It is especially desirable to do this after continued westerly gales, when a north-westerly current sometimes sets across the entrance of the Channel for a considerable distance out to sea, by which a vessel may be drifted to the northward of Scilly.

In thick and foggy weather it is better to enter between the parallels of $49^{\circ} 15'$ and $49^{\circ} 25' N.$, as between them the depth and nature of the bottom indicate the ship's position with the least uncertainty, and because of the general northward tendency of the tides at the entrance. Steering to the eastward between these parallels, depths of about 300

fathoms, sand and dark-green ooze (or slime,) are met with in lon. $11^{\circ} 30'$ W. The same bottom with depths of 100 fathoms will be found in lon. $10^{\circ} 55'$ W. About 25 miles farther east the Great Sole Bank is reached, when the bottom suddenly rises from 80 to 70 fathoms, coarse and fine reddish-yellow sand and shingle. This bank is about 9 miles wide, and extends in a N. N. W. direction about 36 miles, its southern end being in lat. $49^{\circ} 4'$ N., lon. $9^{\circ} 55'$ W. East of the Great Sole Bank the depth increases to 80 fathoms again, and the bottom of sand and ooze reappears. In lon. $9^{\circ} 30'$ W. the bottom changes to clear sand, and no ooze is found farther east, south of the parallel of $49^{\circ} 17'$ N., but on the parallel of $49^{\circ} 25'$ N. ooze is found from lon. $8^{\circ} 40'$ W. to the Haddock Bank, in lon. $7^{\circ} 50'$ W., where the depth suddenly diminishes from 75 to 62, and 58 fathoms, coarse light yellow and dark gray sand, alternately with shingle.

This bank lies in a northeasterly direction, and from its southern end the Scilly Islands bear E. $\frac{1}{2}$ N. 70 miles. The depth increases again when it is passed, and ooze will be found mixed with the sand for eighteen miles farther east, until it finally disappears in lon. $7^{\circ} 20'$ W.

It is well, therefore, in thick weather, when east of lon. 10° W., to find a safe parallel for entering, by running southward, if bound from the northwest, until the ooze disappears, or by running northward, if bound from the southwest, until it is found mixed with the sand.

Parallel of Scilly. On the parallel of Scilly ($49^{\circ} 53'$ N.) a depth of 100 fathoms, fine dark-brown sand, will be found in lon. $10^{\circ} 45'$ W.; and on the northern part of Cockburn Bank, in about 9° W., 67 to 60 fathoms, sand. Still farther east lies Jones Bank, the shoalest part of which is in lat. $49^{\circ} 53'$ N., lon. $7^{\circ} 58'$ W., 63 miles west of Scilly. Depths of 39 to 60 fathoms are found on this bank, which is composed of fine and coarse gray and yellow sand, interspersed with brittle, shelly substances, and minute, yellow-reddish angular stones. The ground around it is wholly ooze, with depths of 65 to 70 fathoms close to. The tide causes ripplings on all parts of it, especially between four-hours ebb and high water. At a distance of 18 miles from Scilly, between the limits N. N. W. and S. $\frac{1}{2}$ W., are depths of 55 to 60 fathoms, shoaling gradually to 45 fathoms close to the . .

rocks, the bottom being fine or coarse mixed sand of a pale white or grayish color, which becomes coarser and darker as the islands are approached. Within this distance there is no ooze, or anything that can be mistaken for it, in any direction. At night, or in thick weather, the Scilly Islands should not be approached within 60 fathoms.

On the parallel of Ile d'Ouessant ($48^{\circ} 28' N.$) 100 fathoms will be found in lon. $10^{\circ} 45' W.$, with irregular depths to the eastward as far as $8^{\circ} W.$ The shoalest part of the Little Sole Bank, 153 miles W. by N. $\frac{3}{4}$ N. from Ouessant light-house, has a depth of 66 fathoms, coarse or fine grayish sand mixed with small reddish-black and yellow pebbles, and pieces of various shells. It shoals in patches of 88 to 66 fathoms, all of which are steep-to, having from 90 to 135 fathoms between them. The bank, as well as the whole extent of the edge of soundings, may always be discovered in fine weather from the numerous rippings in its vicinity, and in boisterous weather the transition from deep to shoal water is rendered apparent by the sudden alteration in the color of the water, which changes from blue to a disturbed green. As Ouessant is approached the depth decreases very slowly, the bottom being a sort of pale-yellow ground, resembling semi-indurated marl, and a mealy surface interspersed with broken pieces of shell, and a substance like chaff; and 65 fathoms will be found within nine miles of the rocks. Near Ouessant, as all along the French coast, the bottom is of coarse gravel with rocky substances. In thick weather do not come into less than 70 fathoms, and keep the lead going.

To the southward of Ouessant the transition from deep to shoal water is very sudden.

When running east between the parallels of $49^{\circ} 15'$ and $49^{\circ} 25' N.$, if the water shoals to 68 and 66 fathoms, with soundings of fine sand mixed with pieces of white and yellow shells and minute brown angular granite, as well as other stones of different shapes, unconnected with ooze, Scilly will bear nearly E. N. E., distant about 40 miles. After running about 24 miles farther east, or to the meridian of Scilly, 65 and 60 fathoms will be found on the parallel of $49^{\circ} 25' N.$ and 67 fathoms on that of $49^{\circ} 15' N.$ The bottom will be coarse sand, mixed with rotten rocky substances

Parallel of Isle
d'Ouessant.

Making Lizard
Head.

and flat shells, and thence a course may be shaped for Lizard Head.

There are 49 and 47 fathoms on the meridian of the Lizard, 12 miles from it, and 51 fathoms at a distance of 24 miles.

In running for it, from the position just mentioned, the depths will diminish gradually at the rate of about 4 fathoms every 9 miles, and the ground, after passing the meridian of Scilly, will change to a pale whitish color, resembling that of semi-indurated marl with a mealy surface. On the meridian of the Lizard, in 51 fathoms, the bottom is of a corresponding description, with a variety of broken shells. The soundings off the Lizard, between the distances of 21 and 15 miles, in any direction between W. $\frac{3}{4}$ S. and S. by E. $\frac{1}{2}$ E., do not materially differ, the greatest variation being from 51 to 45 fathoms, and thence the depths gradually decrease to 40 fathoms within 3 miles of the land. At 5 and 4 miles to the southeastward of the Lizard the soundings are 5 and 4 fathoms deeper and the ground coarser than at similar distances to the southwestward and southward. In thick weather it should not be approached within 45 fathoms.

Running up the
Channel.

The fairway of the Channel, to the eastward of Ouessant or the Lizard, should always be considered as within the limits of 12 and 24 miles from the English coast, if the wind will permit; not only in consequence of the dangers which exist on the opposite coast, but because the depths increase and decrease more progressively on the English than on the French shore. Toward the latter the water in the entrance of the Channel is generally from 8 to 10 fathoms deeper; the bottom is coarser, the stones are larger, the different substances altogether more loose and unconnected, and the compound of a paler color than on the northern side of the Channel. Close attention, therefore, to the character of the soundings, together with the remarkable rippings and overfalls which so generally prevail even in the finest weather off the French coast, will always indicate the vessel's position relative to the Channel fairway.

After passing Start Point, should it be necessary to gain an offing to the southward, and in doing so the water is found to deepen suddenly from 37, 39, and 40 fathoms to 50,

55, and 60, it may be inferred that the vessel is in or near the stream or parallel of the Casquets, either in Mellville Pit or in the southwestern part of Hurd's Deep; in either case she should haul to the northward, into the fairway, carefully bearing in mind the set of the tide. Mellville Pit is 33 miles W. N. W. of the Casquets; in its center, which is of small extent, there is 62 fathoms water. The southwestern portion of Hurd's Deep is 37 miles W. $\frac{1}{2}$ N. from the Casquets, with general depths of from 50 to 60 fathoms. It thence trends round the northern side of the Casquets, stretching away northeastward of Alderney nearly as far as the meridian of Cape de la Hague, and in this part of the Deep the soundings range from 60 to 95 fathoms. From the latter depth the Casquets bear S. W. by S. 8 miles, and from the depth of 92 fathoms they bear S. S. E. $8\frac{1}{2}$ miles. Between these positions, a distance of $7\frac{3}{4}$ miles, is the deepest part, and the soundings vary from 81 to 93 fathoms. Though other discrepancies may be traced among the soundings in various parts of the channel, there are no such corresponding transitions from shoal to deep water to be found anywhere else.

The prevailing winds in the Channel are those from the western quarter, which generally blow during two-thirds of the year. Gales from the westward are felt in all seasons, but from November to March, inclusive, they are most frequent and generally last three or four days. Of these a S. W. gale is considered the most dangerous in the eastern part of the Channel, for, when accompanied by rain, it blows in violent gusts, and sometimes suddenly changes its direction to N. W., N., and even to N. E., without losing its strength, and causes, in a few hours, a heavy sea on the French coast.

If the wind remains fixed in either of the latter points, and its force moderates, the weather becomes fine; but should it back round to the S. W., bad weather is sure to return.

It has been generally remarked that those gales which occur during spring-tides are more violent and last longer than those which take place during the neaps, and that it is at the beginning of the flood that they acquire their greatest strength.

Gales from N. to N. E. are also violent, but they usually

last only from 24 to 36 hours, and the wind does not shift as it does with those from the westward. They cause a heavy sea on the flood-stream, and during their continuance the land is covered with a white fog, which has the appearance of smoke. This is also the case with all easterly winds, which are sometimes of long duration and blow with great force.

When S. E. winds are accompanied by rain they are often violent, and almost always turn into gales, during which the wind in the squalls flies quickly round to N. E., and sometimes to N. and N. W., making it dangerous to be upon the French coast when these unexpected changes take place. If it remains fixed in either of the latter points, and moderates, the weather is soon re-established; but should it return to the S. E. or S., the bad weather will continue.

Moderate winds from N. W. to N. E. bring fine weather. In the summer the N. E. winds blow more particularly in the afternoon. In the morning there is a light breeze from the S. E., but toward noon it changes to N. E. and freshens; toward evening it decreases; at night a calm ensues, and the cool air condenses the vapors. When this condensation does not take place it is a sign of a change of wind.

Calms are of rare occurrence and do not last long, except in summer. When they occur during winter it is regarded as the precursor of bad weather. The most certain indication of bad weather is swell in the offing during a calm, and surf on the coast.

In wet winters snow is abundant, and when it blows the wind continually changes its direction, and the snow, which whirls and obscures the air, prevents the land from being seen. During the intervals of these snow-showers there is often great difficulty in recognizing the coast which may be in sight, as the snow completely changes its appearance.

The greatest quantity of hail falls during the months of March and April. These hail-showers cause sudden changes in the direction of the wind, and are consequently dangerous to sailing-vessels navigating near the shore.

Fogs.

Fogs are frequent in all parts of the Channel, and are formed both on the English and French coasts, in the valleys and low marshy lands, whence the winds drive them out to sea. In summer they only hide the land in the morning, as they are readily dispersed by heat or a light breeze; but the

moist haze, driven in by westerly winds from the sea, is more tenacious, and only yields to strong winds. This haze always causes a short sea, and, frequently turning to rain, brings bad weather.

In the eastern part of the Channel it is rare for the land to be completely free from vapors, unless previous to strong N. E. winds, when it may be distinctly seen from a great distance. The winds from the western quarter, as has been remarked, bring thick clouds which frequently hide the land; and when it blows strong from the eastward the vapors which cover the land are dense in proportion as the wind is strong and lasting.

Mirage is frequent on the French coast during the season of fine weather, of which it is considered an indication, when it only tends to increase the apparent size of objects; but when it distorts them so as to render them difficult of recognition it is deemed a sign of rain or strong easterly winds.

Extensive and careful observations on the tides of the English Channel have shown that instead of a stream which turns progressively later as the tide advances up the Strait, the progressive changes of stream cease at a certain point near the mouth of the channel, and that beyond that spot there is a tide peculiar to the Channel, and quite distinct from that of the seas on either side of it. These two streams—that of the Ocean or outer stream and that of the Channel which is contained between the oceanic stream and the Strait of Dover—are always running in contrary directions, and meet between Start Point and the Gulf of St. Malo.

Tides.

In the localities where these streams meet the tide is ever varying its direction, as the strength of one stream prevails over that of the other, giving to the water a rotatory motion, and scarcely admitting of any interval of slack water; while in the space between these rotatory tides and the point of meeting of the Channel Tide with that of the North Sea, in the Strait of Dover, the stream is free from all rotatory motion, and sets steadily throughout the tide in a direction toward Dover while the water is rising at that place, and away from it while it is falling there.


The Channel Tide and that of the North Sea always run in opposite courses, meeting and separating in the Strait of Dover. But in this strait the stream, although it obeys first

one and then the other of these tides, does not slack with them, but is found to be still running at high and low water on the shore, at which times they are at rest, so that the Strait of Dover never has slack water throughout its whole extent at any time. This is therefore called the intermediate tide.

The limits of neither of these streams appear to be stationary, but range to and fro as the tide rises and falls at Dover, traveling to the eastward on both tides, and at high and low water suddenly shifting sixty miles to the westward, to recommence their easterly courses with the next tide.

In the Strait of Dover this line of meeting and of separation oscillates between Beachy Head and the North Foreland, a distance of about sixty miles. When the water on the shore at Dover begins to fall, a separation of the streams begins off Beachy Head. As the fall continues, this line creeps to the eastward. At two hours after high water, it has reached Hastings; at three hours, Rye; and thus it travels on until at low water, by the shore, it has arrived nearly at North Foreland on one side of the strait, and at Dunkerque on the other. At this time the streams on both sides slack, but in the intermediate stream of the Strait the water is still running to the westward; and when the new streams make as the water rises on the shore, it unites with that entering from the North Sea; so that, as before mentioned, the line of meeting at low water appears off Beachy Head to recommence its easterly course. This intermediate stream forms a remarkable feature in the tidal system of the Channel; it is well established, as the line of meeting and of separation occupies a very limited space, and it seems to be entirely due to the contracted form of the Channel in this immediate locality, preventing the free escape of the water.

The Channel Stream, running between the intermediate stream and the rotatory, or mixed streams in the outer part of the Channel, pursues a steady course along the main trunk of the Strait, slacking only towards high and low water at Dover, when it is preparing to invert its course; and contrary to the generally received opinion of a progressive slack water in a strait having a progressive establishment, this stream has the peculiarity of slacking throughout its whole



extent at nearly the same time. With exceptions arising from extraneous causes, for which allowance must be made, the streams of the Channel turn sufficiently near to the times of high and low water on shore at Dover to be considered simultaneous with them without occasioning any error that can be of the smallest consequence to shipping. They also acquire their greatest velocity, which varies in different parts of the Channel from one to more than five knots, about the time of half tide at Dover.

The plates at the end of this volume, reduced from those which illustrate a paper on the "Tidal Streams of the North Sea and English Channel," by Capt. F. W. Beechey, R. N., F. R. S., published in Phil. Trans. Roy. Soc. MDCCCLI, show the course of the streams at different stages of the tide. In these plates the direction of the stream is indicated by arrows, which are connected by curved lines empirically drawn through them; these lines are continuous when the stream is flowing toward Dover, and broken when it runs in the opposite direction. The numerals on the plate which shows the direction of the streams at half ebb, or 3 hours after high water at Dover, indicate the greatest rate of spring tides at the localities where they are found. It is high water at Dover, full and change, at 11h. 12m.

The Gulf of St. Malo, from its high and strong tides, exercises a powerful influence over the navigation of that part of the Channel in its immediate vicinity, and the seaman must be especially on his guard when drawing near this locality. With a falling water at Dover, the stream sets sharply into this Gulf on both sides of the Channel Islands, which the prevalence of westerly winds is said to increase; but with a rising water at Dover, it sets across and out of the Gulf, the northeastern part of the stream sweeping round the Casquets toward Alderney, and through the Russel and other channels about Guernsey, toward the race of Alderney.

On the south side of the Channel, with a rising water at Dover, the stream sets sharply round Cape Barfleur into the Baie de la Seine, curving more and more with the bight of the bay, until it finally takes the sweep of the shore. With the flood-tide the western half of the bay is partly in eddy, and the tide slacks in all that part nearly an hour before high water at Dover, while in the eastern half of the bay it

runs about half an hour longer than at Dover, so that here a ship beating up channel toward the end of a rising tide at Dover, may prolong the tide in her favor by standing close over to the French coast eastward of Havre.

On approaching Boulogne, however, at the beginning of a rising tide, great attention should be given to what has been said of the direction of the streams in this part of the Channel, as they meet hereabout, and are turned down on the French coast, so that a ship, which on the English side would at this time have a stream setting straight up the Channel, here encounters one upon her beam, sweeping her down toward the entrance of the river Somme, where many wrecks have occurred.

Magnetic variation.

The true direction of the magnetic meridian in the outer part of the English Channel is about N. N. W. at the present time, and that of the lines of equal variation N. N. E., or nearly at right angles to the Channel Courses. The variation is less in the eastern than in the western part, the difference between the meridian of Cape Clear and the Downs being about 6° , or something more than half a point.

It appears to be diminishing, in all parts of the Channel, at the average rate of about $7'$ annually.

The actual variation for the year 1870, at different points, will be given with their local descriptions.

CHAPTER II.

SCILLY ISLANDS TO LIZARD HEAD.

The Scilly Islands, and rocks in their vicinity, lie about 21 miles westward of the Land's End of England, and occupy a space of about 47 square miles. The group consists of 48 islands; of these only 5 are inhabited, viz, St. Mary, St. Agnes, St. Martin, Trescow, and Bryer; the others are more or less barren. All are tenanted by gulls and rabbits, and the rocks in their vicinity, above and below water, are too numerous to admit of description. The chief exports are early potatoes, many tons of which are annually shipped to London and Bristol, and lobsters. The imports consist of timber, coals, flour, bread, and general merchandise. Coals are put on board steamers at 3s. and water at 15s. per ton; but fresh provisions are not immediately attainable.

The Scilly Islands.

These islands may be discerned in clear weather at the distance of 15 miles; and by night the light on the summit of St. Agnes may be seen from about the same distance.

In the year 1637 a conical stone beacon, or day-mark, 38 feet high, was erected on the eastern point of St. Martin; it is painted with red and white horizontal bands, and its summit is 185 feet above the level of high-water ordinary springs. This beacon, together with the telegraph-tower on the highest part of St. Mary, the old wind-mill on Peninnis Head, the south part of that island, and the Star fort on its western end, are good land-marks, and serve well to point out this dangerous group.

The near approach to these islands from the southwestward and westward requires great judgment, by reason of the rocky ledges which project in those directions, the principal of which are the Nundeeps, Crim, Bishop, Crebinack, Bishop's Ridge, and Shovel.

The Crim and Bishop, the westernmost rocks of Scilly, are always above water, and on the latter is a stone light-house. The tide at a little to the southwestward of the Crim and Bishop runs strong to the northwestward, north, and northeastward 8 hours out of 12. The southeastern shores of

St. Agnes, St. Mary, and Menewethan Islands may be approached as near as half a mile, as there are no dangers without that distance.

From the rocky ledge called the Poll Bank, St. Agnes light-house bears E. by N. $\frac{1}{4}$ N. $6\frac{1}{2}$ miles, but it carries a depth of 15 to 16 fathoms, is surrounded by deep water, and is in no case dangerous, otherwise than to open boats in boisterous weather. The old wind-mill on Peninnis Head, in line with Goreggan Islet, (a quarter of a point, open eastward of the light-house,) leads directly to it.

Harbors
pilots. and

The Scilly Islands possess several harbors for vessels capable of taking the ground, and also one for those of great draught, viz, St. Mary Road; the ground, being loose sand, is not very tenacious, and generally anchors come home long before a stay-peak can be obtained. The harbors in most esteem are Old and New Grimsby, and St. Helen's Pool.

Strangers are not recommended to attempt the harbors of Scilly, without pilots, whose attendance may always be depended on, even in the worst weather, as soon as the signal for that purpose is made. There are no less than 11 vessels distributed among the islands, and the conduct of the pilots is marked by skill and intrepidity.

A rocket apparatus is kept in the coast-guard watch-house, near the custom-house at St. Mary, in case of shipwreck.

Bishop
light. Rock

The Bishop Rock light-house stands on the southwesternmost of all the dangers of the Scilly group. It is of stone, painted white, 147 feet high, and exhibits a fixed bright light at an elevation of 110 feet above high water, which should be seen in clear weather from a distance of 16 miles in any direction, except when bearing between S. W. by W. and W. N. W. $\frac{3}{4}$ W.; in which direction it is obscured by the land. When bearing W. by S., however, it may be seen between the islands of St. Martin and St. Mary. It bears W. $\frac{3}{4}$ N. 4 miles from the light-house on St. Agnes Island. A bell is sounded during foggy weather.

St. Agnes light-

A stone light-house 74 feet high, and painted white, stands on the summit of St. Agnes Island, and exhibits, at an elevation of 138 feet above high water, a revolving bright light, which attains its greatest brilliancy every minute, and in clear weather should be visible from a distance of 17 miles, except when bearing between S. by W. and

W., where it is only seen at intervals, being obscured by the northern islands of the group.

St. Mary Road is said to be an excellent roadstead in easterly gales, with convenient depth of water and good holding-ground. At St. Mary ship-building is carried on, and there are facilities for repairs of all kinds. Water, provisions, and coal may be obtained at all times. St. Mary Road.

St. Mary Road affords shelter from all winds, except those from the westward, between S. W. and W. N. W.; these send in a heavy sea, but a vessel can run to sea, through Crow Sound, at a proper time of tide. The anchorage is between the island of St. Mary and that of Samson, and there are five entrances to it, viz: St. Mary Sound; Smith Sound; Crow Sound over Crow Bar; Broad Sound, and the North Channel, between the Mincarlow Rock and the Nun-deeps.

St. Mary Sound, the best entrance into the road, has a general depth of 6 to 13 fathoms, but its navigation is rendered intricate by Wetnose Shoal, Round Rock, and Perconger Ledge, lying off the western shore; by the Little Ledge, the Spanish and Bartholomew Ledges, in mid-channel; by the Gilstone, Pollard, and Woolpack Rocks, off the eastern shore; and the Frisky and Woodcock Shoals, lying off the northwest shore of St. Mary. St. Mary Sound.

. When bound to St. Mary Road through St. Mary Sound, bring the northeast end of the Mincarlow Rock on with the middle of the Great Minalto Rock, N. N. W. $\frac{1}{2}$ W., and it will lead in the fairway between Woolpack Rock to the eastward, and Little, Spanish, and Bartholomew Ledges to the westward. Peninnis Head and Stevel Rock are both bold close to. Directions.

Continue with the above marks on until the day-mark on St. Martin comes in line with Greeb Rock, N. E. by E. $\frac{1}{2}$ E., then steer direct for the anchorage in St. Mary Road. The best position is with Hangman Island its own breadth open northward of Nut Rock, and distant from the latter one-third of a mile to the southeastward, in 4 or 5 fathoms water. If intending to moor, place the anchors to the N. W. and S. E. to insure open hawse with westerly winds.

Broad Sound is mostly used by vessels from the south-westward, but is dangerous to such as are not well ac- Broad Sound.

quainted with the marks and the set of the tides. Run in between Bishop light-house and the Crim Rock, but nearer to the light-house. The leading mark is Nornour Island, its apparent length open northward of Bants Carn Point, about E. $\frac{3}{4}$ N.

In proceeding with these marks on, the Gunner, southward, and Le Jeffrey Ledges will be left to the northward, and Old Wreck Rock to the southward; and, after passing these dangers, it will lead direct to St. Mary Road, where anchorage may be taken up as before. The Old Wreck is a sunken rock with 3 feet on it, lying about N. N. W. $\frac{1}{4}$ mile from Annet Head, and N. W. by W. $\frac{3}{4}$ W. from Great Smith Rock.

North Channel. The North Channel is as dangerous as Broad Sound to strangers. The best mark is St. Agnes light-house in line with Great Smith Rock S. S. E. $\frac{1}{4}$ E., till the leading marks through Broad Sound come on as above.

Crow Sound. If it becomes necessary to run to sea through Crow Sound, the depth of water over Crow Bar may be estimated by the appearance of Crow Rock.

This rock lies off the north end of St. Mary, near Bants Carn Point, and has an iron beacon with cage erected on it. It has three distinct heads, called Great Crow, Little Crow, and Crow Foot.

The Great Crow is nearly awash at 5 hours' flood; the Little Crow is awash at about 4 hours' flood, or after two hours' ebb; and the Crow Foot is nearly awash at one-quarter flood, or three-quarters ebb.

At high water, ordinary springs, there is 21 feet on Crow Bar; at three-quarters flood or one-quarter ebb, 17 feet; at half flood or half ebb, 11 feet; at one-quarter flood or three-quarters ebb, 5 feet; and at low water 1 foot; but more with westerly gales and less with those from the eastward.

Magnetic variation. The magnetic variation at the Scilly Islands was $22^{\circ} 53'$ W. in 1870, decreasing at the rate of $7'$ annually.

Tides. It is high water, full and change, at about 4h. 30m.; equinoctial tides rise 20 feet, ordinary springs 16 feet, and neaps 12 feet. When it has been blowing hard from the southward, the tide flows about an hour longer, and northerly winds keep it back in the same proportion.

About 6 miles southward of the islands the tides appear to set straight, and run for equal spaces of time to the east-

ward and westward, but nearer to and among the islands and rocks they are subject to a variety of inflections and inequalities.

The flood sets from the S. W. around the islands on their east and west sides, and the two streams meet on the north-east.

Through St. Mary Sound the tide sets from the southward from half ebb to half flood, and from the northward from half flood to half ebb. The flood sets regularly through St. Mary Road from Broad Sound and over Crow Bar, through Crow Sound to the eastward; the ebb sets in a contrary direction, but it is not strong.

Through the North Channel the flood sets into St. Mary Road, and the ebb in the opposite direction.

The tide coming in through Broad Sound from the southwest sets through St. Mary Road, toward the east end of St. Martin, where it meets the tide at 4 hours' flood coming round St. Martin Head, which makes the race of Hanjague; this latter prevailing, sets away S. W. by S. as far as Menewethan Island, where, meeting the Crow Sound tide, which runs out S. S. E., it makes an extensive race, with spring tides, and both go off to the southward together.

To the S. E. and S. of St. Agnes there is a great rippling or overfall, between 4 hours' flood and 2 hours' ebb, occasioned by the confluence of the two streams of tide at that period. This overfall is further augmented by the unevenness of the ground over which the water runs, and sometimes extends as far seaward as 3 miles, but gradually subsides as the tides assimilate.

A rock, said to have been discovered by Captain Thompson, of the ship Betty, which struck on it in 1775, is marked on old charts about 9 miles E. S. E. $\frac{1}{2}$ E. from St. Agnes. It is reported to have been seen since, but has been searched for without success. Thompson Rock.

The Seven Stones is a cluster of dangerous rocks, lying nearly in the fairway between Scilly and the Land's End. It is a mile in extent N. N. W. and S. S. E., and is covered at high water. In rough weather the breakers upon it may be seen from a considerable distance. The two principal rocks of the cluster are the Pollard, which appears at half ebb, and the South Stone, which shows at 5 hours' ebb. From the Pollard, which is the northwesternmost rock, the day-mark Seven Stones.

on St. Martin bears W. S. W. $\frac{1}{2}$ W. 7 miles; the telegraph on St. Mary, W. S. W. $9\frac{1}{2}$ miles; the Seven Stones light-vessel, E. nearly 2 miles; and the Longships light-house, E. S. E. $\frac{1}{3}$ E. 15 miles. The South Stone lies S. S. E. $\frac{3}{8}$ E. $\frac{3}{8}$ mile from the Pollard.

There are several other sunken rocks in the vicinity of these two, particularly to the northward and eastward of the Pollard, and to the westward of the South Stone; the former are generally called the Town, and partially appear between 4 hours ebb and low water; the latter have no particular name.

All these dangers are steep-to, there being 38 and 40 fathoms on all sides at the distance of a mile. The only marks for the position of the Pollard, which can be rendered conspicuous or intelligible to a stranger during the day, are the telegraph tower on St. Mary, in line with the northwest end of Nornour Island, or Bants Carn Point, open eastward of Carniweather Point. The telegraph tower on St. Mary, open eastward of the easternmost Carn of Great Granilly Islet, (it will, at the same time, be open eastward of the remarkable conical-shaped rock called Hanjague,) will lead a half mile southeastward of the South Stone and the rocks near it, and the telegraph shut in westward of Carniweather Point, (though its parapet will still appear over the land between the point and the day-mark,) will lead a half mile westward of the Pollard and the rocks in its vicinity.

In clear weather objects on the Land's End may point out the position of the Seven Stones; for instance, the two churches of St. Buryan and Sennen, in one, will pass over the rocks to the northeastward of the Pollard.

Light-vessel.

The Seven Stones light-vessel is moored in 40 fathoms water, nearly 2 miles E. from the Pollard, and $1\frac{3}{4}$ miles E. N. E. $\frac{1}{2}$ E. from the South Stone, and as long as she holds fast in that exposed situation there will be no difficulty in the passage between them and the Longships. She carries, on separate masts, two fixed bright lights, 20 and 38 feet above the sea, visible in clear weather from a distance of 10 miles. St. Martin's day-mark bears W. S. W. $\frac{3}{4}$ W. from her, nearly 9 miles distant; the Longships light-house, E. S. E. $\frac{1}{4}$ E, $13\frac{1}{4}$ miles; and the Wolf Rock, S. E. by S. $12\frac{3}{4}$ miles. The vessel is painted red, with the name "Seven

Stones" on her sides, carries a ball at each mast-head, and a gong is sounded on board in foggy weather.

The Wolf is a half-tidal rock, lying E. S. E. $\frac{3}{4}$ E., 20 $\frac{3}{4}$ miles from St. Agnes light-house; S. W. $\frac{1}{3}$ S. 7 $\frac{3}{4}$ miles from the Longships light-house; and W. N. W. 23 $\frac{3}{4}$ miles from the light-houses on Lizard Head. At low water ordinary springs, its length is 182 feet, north and south, its breadth being 152 feet, and it is nearly awash at high water neaps. It is steep-to, and there are 34 fathoms within a mile on all sides. Wolf Rock.

The light-house is a circular granite tower, and exhibits, at an elevation of 110 feet above high water, a revolving light, showing alternate flashes, red and bright of equal intensity, at intervals of 30 seconds, which should be visible in clear weather from a distance of 16 miles. A bell is sounded during foggy weather, three times in quick succession every quarter of a minute. Light-house.

Bann Shoal is a narrow, rocky ridge, about three quarters of a mile in extent, N. N. E. and S. S. W., with irregular depths from 8 to 20 fathoms on it. From the shoalest part, in 8 fathoms, St. Ives Head, or Battery Point, bears S. E. by E. 12 $\frac{1}{2}$ miles; and Sennan Church is in line with the extremity of Cape Cornwall, at high water, S. by W. $\frac{1}{4}$ W. 12 miles. Bann Shoal.

Cape Cornwall Bank is a narrow ridge about three miles long, N. N. E. and S. S. W., lying S. W. $\frac{1}{2}$ W. 6 miles from Bann Shoal. The depths on it vary from 20 to 13, and perhaps 10 fathoms, or even less. Cape Cornwall Bank.

As the sea breaks heavily in bad weather on both the above shoals, particularly during northwest gales, their locality should at such times be avoided, especially by small or heavily-laden vessels. The coast being so far distant, no good marks can be given for clearing them; but in proceeding round the Land's End to the northward if the weather be clear, the Longships light-house kept S. $\frac{1}{4}$ E., will lead a mile westward of Cape Cornwall Bank; the Brisons Islets S. by W., or at night the Longships light dipping and bearing S. by W. $\frac{1}{2}$ W., will lead between the shoals, and Cape Cornwall S. S. W. will lead a mile eastward of Bann Shoal.

The Brisons are two rocky islets, 90 and 71 feet above high water, lying W. $\frac{1}{2}$ S., $\frac{1}{2}$ mile from Cape Cornwall, and The Brisons.

N. E. $\frac{1}{4}$ N. $3\frac{1}{2}$ miles from the Longships light-house. Between them and Pol Pry Point are various rocky ledges which cover at quarter flood, and shoal water extends nearly a cable length S. W. by W. $\frac{1}{2}$ W. from the lower islet; and at the same distance W. $\frac{3}{4}$ N. is a small patch of only 16 feet.

Longships Rocks. About 3 miles N. N. W. $\frac{1}{2}$ W. from Tol Peden Penwith, or the southeastern extremity of the Land's End, and a mile W. N. W. from Peal Point, is a group of high detached rocks called the Longships, on the largest and most elevated of which stands a light-house, from which the Brisons bear N. E. $\frac{1}{4}$ N. $3\frac{1}{2}$ miles; the Runnelstone S. S. E. nearly 4 miles; the Wolf light-house S. W. $\frac{1}{3}$ S. $7\frac{1}{2}$ miles; and St. Agnes light-house W. $25\frac{1}{2}$ miles. The summit of the light-house rock is 44 feet above high water, ordinary springs, and a ledge extends S. S. E. $\frac{1}{2}$ E. from it nearly half a mile. The other rocks vary from 44 to 20 feet in height.

At the distance of $\frac{3}{8}$ mile N. E. by E. $\frac{1}{2}$ E. from the light-house lies Shark's Fin Rock, which covers at two thirds flood, and is steep to except off its western side, where a shoal, with only 9 feet on it, projects a third of a cable-length. A rocky shoal called the Ketel Boton, which covers at three-quarters flood, lies E. S. E. $\frac{3}{4}$ E., $\frac{3}{8}$ mile from the light-house, and shoal water extends a quarter of a mile S. W. $\frac{1}{2}$ S. from its highest part. Between the Ketel Boton and Shark's Fin is a small rock called the Fe-les, which covers at a quarter flood, and has deep water around it.

Light-house. The Longships light-house is white, 51 feet high, and exhibits a fixed bright light, 85 feet above high water, which is visible in clear weather from a distance of 14 miles.

Carn Base. The soundings are irregular, from 2 to 3 miles S. S. W. $\frac{3}{4}$ W. from the Longships light-house; and $2\frac{1}{4}$ miles in that direction, and the same distance off shore, is a rocky patch of 9 fathoms, named the Carn Base, from which Chapel Carn Brea is just open eastward of Sennan Church W. S. W.

**Directions
— Land's End
Channel.**

When navigating between Scilly and the Land's End, do not run between the Seven Stones and the light-vessel, but pass eastward of her, keeping her to the westward of S. when approaching from the northward, and to the westward of N. when approaching from the southward.

Vessels bound round the Land's End from the eastward will open the Longships light of Tol Peden Penwith when

it bears N. N. W. $\frac{1}{4}$ W., and by steering for it on a N. $\frac{1}{2}$ W. bearing they will clear the Runnelstone. The Longships may, if requisite, be passed at the distance of two cable-lengths. Having rounded the Longships, and bound to the northeastward, by not bringing the light to the westward of S. S. W. $\frac{1}{4}$ W., it will lead about a mile westward of the Brisons.

There is a good channel nearly $\frac{1}{2}$ mile wide inside the Longships, between the Ketel Boton and Peal Point. It carries 8 to 11 fathoms water, but is seldom used except by coasters. The leading mark through is the highest part of the northern Brison appearing westward of the highest part of the southern or lower Brison, N. N. E. $\frac{1}{4}$ E.

Whitesand Bay is between Cape Cornwall and the Land's End, and in the middle of it is Bounder Rock with $3\frac{3}{4}$ fathoms over it, from which Mathew's house is in line with Sennan Church, bearing S. by W. Vessels will ride well sheltered from easterly winds in 12 to 15 fathoms outside this rock, about $\frac{3}{8}$ mile off shore, with Cape Cornwall N. N. E. $\frac{3}{4}$ E.; but the danger arising from westerly winds makes this bay little frequented.

Whitesand Bay.

A life-boat is kept in Sennan Cove, in the southern part of Whitesand Bay, which is a coast-guard station; there is also a rocket apparatus in readiness in case of shipwreck.

Life-boat.

The Land's End, or western extremity of England, may be seen in clear weather from a distance of 8 or 9 leagues; and when first viewed, from the southwestward and southward, has the appearance of two detached hummocks. On nearing the land another hummock, with buildings on it, will appear to the westward; then Cape Cornwall will appear above the horizon, and ultimately the whole will form a continuous line of coast.

Land's End.

The most conspicuous buildings in the vicinity of the Land's End are the churches of St. Buryan and Sennan, the former being elevated 488 feet, and the latter 358 feet, above high water.

From Peal Point, which is the northwestern extremity of the Land's End, the coast trends S. by E. $2\frac{1}{2}$ miles to Guethenbras Point, and the cliffs range in height from 150 to 200 feet. At $3\frac{1}{2}$ cable-lengths S. by W. $\frac{1}{2}$ W. from Peal Point is the Armed Knight Islet, 88 feet above high water; and N. W. $\frac{1}{2}$ N., upward of a cable-length from Peal Point, are the

Peal Rocks, awash at low water. A patch of two fathoms lies $1\frac{1}{2}$ cable-lengths to the northwestward of the Armed Knight, and off all the intervening points to Guethenbras are a number of outlying rocks extending about half a cable-length off shore, and covering from a quarter to half flood.

Magnetic variation.

The magnetic variation at the Longships in 1870 was $22^{\circ} 33'$ W., diminishing at the rate of $7'$ annually.

Tides.

It is high water full and change at the Land's End at 4h. 15m.; springs rise $22\frac{1}{2}$ ft.; neaps, $16\frac{1}{2}$ ft.

The Runnelstone.

The Runnelstone is an exceedingly dangerous rock lying about $\frac{3}{4}$ mile S. from Tol Peden Penwith, which is of only a few feet in extent, and covers at two-thirds flood. It bears from Longships light-house S. S. E. nearly 4 miles, and its position is indicated by two beacons at Porthgwarrah, near Tol Peden Penwith, which in line N. by E. $\frac{1}{2}$ E. lead over it. The southernmost or outer beacon is of a conical form and painted red, the inner or northernmost has a large extended base, and is colored black, except a small part of the pillar immediately above the base, which is white.

The Lee Mean, awash at low water, lies S. E. by E. $\frac{3}{4}$ E., distant $\frac{1}{2}$ cable-length; the Carnstone, with 8 feet over it, N. W. by N. one cable-length; and the Poldew, a rocky ledge with 4 fathoms on it and 8 to 13 fathoms close to, lies W. N. W. 3 cable-lengths from the Runnelstone. A rocky patch called the Lee Ore, with 11 feet, lies 4 cable-lengths N. E. $\frac{1}{4}$ E. from the Runnelstone, directly in the passage between it and the coast.

Bell buoy.

A black bell-buoy, bearing a staff and ball, is moored in 16 fathoms water about 70 yards S. W. $\frac{1}{2}$ W. of the Runnelstone, with the beacons N. by E., and the Longships light-house N. N. W., but it frequently breaks adrift.

Directions.

Godolphin Hill, in line with Carndu Point, E. $\frac{1}{2}$ N., leads about $\frac{3}{4}$ mile southeast of the Runnelstone; at night, the Longships light N. $\frac{1}{2}$ W. leads nearly a mile to the westward.

The Lee Ore may be passed on either side in good weather; a stranger, however, should not attempt the passage inside the Runnelstone. To pass between the Lee Ore and the Runnelstone, bring the Longships light-house well open of Guethenbras Point N. N. W. $\frac{1}{4}$ W., and when St.

Levan Church comes open of the land the vessel will be southwest of all danger in the vicinity of the Runnelstone.

Off Guethenbras Point the rocks extend W. $\frac{3}{4}$ S. nearly 2 cable-lengths, the outermost covering at a quarter flood; ^{Guethenbras Point to Mount Bay.} thence the rock lying a cable-length off Tol Peden Penwith bears S. E. $\frac{1}{4}$ mile. At the distance of 2 cable-lengths S. E. by E. $\frac{3}{4}$ E. from Ella Point is a rock with only 6 feet on it; and $\frac{1}{2}$ cable-length southward of the point is another rock awash at low water. To the eastward of the point there is a bight called Porthgwarrah Cove, and off its eastern point, which is the western limit of Por-chapel Bay, a ledge of rock extends S. $\frac{1}{2}$ E. nearly a cable-length. A rock also lies S. W. $\frac{1}{2}$ cable-length from Peden-mean-anmear Point.

The cliffs from Guethenbras Point to Castle Treveen Point Rock, which is 2 miles to the eastward, are between 200 and 300 feet high, and the shore forms a number of little inlets. Two detached rocks lie S. W. $\frac{1}{4}$ W. from Castle Treveen Point, the outermost of which is a cable-length off shore. Between Castle Treveen and Tetterdu Points the cliff ranges from 100 to 150 feet in height, with the exception of the low rocky shore of St. Loy Cove, the western extremity of which is Merthen Point.

Penberth Cove, a fishing station, is a half mile eastward of Castle Treveen Point. From Merthen Point the low-water rocks extend upward of a cable-length off shore, and W. $\frac{1}{2}$ mile from Tetterdu Point is the Tregeftian Rock, with only 4 feet on it. Carndu Point, open of Tetterdu Point E. $\frac{1}{2}$ N., leads south of it. Nearly 2 cable-lengths eastward of Tetterdu Point, and about the same distance off shore, are the Buck Rocks, which cover at three-quarters flood.

From Tetterdu Point, which slopes gradually to cliffs not more than 50 feet high, to the southern side of Lamorna Cove the land rises abruptly, the cliffs varying from 60 to 80 feet in height, and from 80 to 100 feet on the northern side of the cove to Carndu Point, which is only 44 feet high.

The Gull Rock, lying off Carndu Point, is precipitous and 80 feet above high water; $\frac{1}{2}$ cable-length W. S. W. from it is a small rock called the Haver, which covers at a quarter flood.

From Carndu Point the cliffs decrease in height, varying from 50 to 40 feet, until near Flat Point, which is only 20 feet high. Nearly 2 cable-lengths eastward of Carndu Point, and about half that distance southward of Flat Point,

is the Lelland Rock, which covers at a quarter flood. Between Flat Point and Penzer Point, which is abrupt, the cliffs gradually rise to 60 and 90 feet, and thence to Mousehole they range from 30 to 40 feet, the high land sloping directly to them.

Mount Bay.

Mount Bay contains five tidal harbors, viz: Mousehole, Newlyn, and Penzance Harbors on the western side of the bay, Mount St. Michael Harbor on the northern side of Mount St. Michael, and Port Leven on the eastern shore. These all dry out at low water and should not be run for with a ground-swell on or during on-shore gales.

The bay affords good anchorage in summer, with shelter from all winds except those between S. S. W. and S. E., which send in a heavy breaking sea, but there is a powerful undertow which assists vessels to ride against it. In winter it should not be resorted to except when about to enter one of the harbors.

Anchorage.

The principal anchorage in Mount Bay is in Gwavas Lake, off Newlyn Harbor. On the eastern side of the bay are several spots of foul ground, but there are places where the bottom is good, and vessels may lie sheltered from easterly winds. Good anchorage will be found during strong easterly or southeasterly gales on the northwest side of Mullion Island, in about 10 fathoms water; great care, however, must be taken to guard against a sudden shift of wind to the westward.

There is also good anchorage in 7 fathoms, fine white sand, sheltered from easterly winds, about a mile to the S. S. W. of Loo Pool; also in 11 fathoms, hard sand, off Port Leven, with Helstone Church N. E. by E. $\frac{1}{4}$ E. and Cuddan Point N. W. $\frac{1}{4}$ N. Between Port Leven and St. Michael's Mount the coast is foul, with many outlying dangers, and vessels of great draught should not venture into less than 14 fathoms.

Mousehole Harbor to Newlyn Point.

Mousehole Harbor, formed by two piers, and sheltered by St. Clement Island, is $1\frac{1}{2}$ acres in extent, and has a depth of 7 feet at high-water springs and 4 feet at high-water neaps, with a bottom of gravel or rocky ground. A rocket apparatus is kept here.

From Mousehole to Penlee Point the shore is rugged, consisting of heavy masses of loose rocks; and near the eastern side of the harbor's mouth are some detached rocks, extend-

ing nearly three-quarters of a cable-length from the land. The cliffs are only 20 feet high near Mousehole, but increase to 50 and 60 feet near Penlee Point, the land rising abruptly to 224 feet, leaving only sufficient space for a roadway, and thence they soon decrease to an average height of 35 feet, the land gradually sloping to them, and this feature continues to Newlyn Point, which is about a mile to the northward.

Low Lee Rock, with 4 feet, lies $\frac{1}{3}$ mile eastward of Penlee Point, with the extremity of the cliff at Penzer Point in one with the northern hummock of St. Clement Island, S. W. $\frac{3}{4}$ W., and the tower of St. Paul's Church in line with a barn W. N. W. $\frac{1}{2}$ W. A red buoy is moored 30 yards eastward of the rock. Low Lee and
Carn Base Rocks.

Carn Base Rock, also, with 4 feet, lies N. nearly $\frac{1}{3}$ mile from Low Lee Rock and about the same distance from the shore, with St. Paul's Church tower W. $\frac{1}{2}$ S. and Trithal engine-house in line with the eastern chimney of the coast-guard house, N.

Low Lee and Carn Base Rocks are of small extent and steep to on all sides.

Newlyn Harbor, formed by a curved pier, has an area of about $\frac{1}{2}$ acre, and a depth of 6 feet at high-water springs and 3 feet at neaps, with a gravel bottom. Newlyn Har-
bor to Penzance
Harbor.

Between Newlyn and Gwavas Slips, which are 83 yards apart, is Gwavas Cliff, about 40 feet high, in the direction of which is the clearest and safest place to beach a vessel; and thence to Tolcarn bridge a flat, stony shore extends off a cable-length from high to low water mark. From Tolcarn bridge to the coast-guard house the rocks, which cover at three-quarters flood, extend $1\frac{1}{2}$ cable-lengths off the shingle beach, and thence to the parade wall at Penzance they run off the same distance from a sandy shore.

Penzance Harbor, in the northern part of Mount Bay, is formed by two piers, has an area of 28 acres, and contains a building-yard and a dry-dock, in which vessels of 800 tons have been repaired. It affords good shelter, but dries at low water. At high-water springs the depth is 17 feet, and at neaps 13 feet. At the eastern extremity of the harbor there is $25\frac{1}{2}$ feet at high-water springs, and $22\frac{1}{2}$ feet at neaps; at the south pier-head there is 6 feet at low water springs. The entrance between the pier-heads is 110 yards wide. Penzance Har-
bor.

MOUNT BAY.

- Life-boat.** The dry-dock is 128 feet in length, 35 in breadth, and has 12 feet over the sill at high-water springs, and 8 feet at neaps; cranes are erected on the piers capable of lifting 5 to 10 tons. A life-boat and mortar apparatus are kept in readiness in the boat-house at the head of Penzance Harbor.
- Light-house.** The light-house on the end of the southern pier of Penzance Harbor is 22 feet high and white. It exhibits a fixed light 33 feet above high water, which shows red through an arc of 80° , or from about a cable-length south of the beacon on the Raymond Rock, to about the same distance east of the buoy on the Gear Rock, when there is 15 feet water at the pier-head, which is quite 8 hours out of the 12, and green where there is less than 15 feet. In all other directions the light shows bright. It should be visible from a distance of 12 miles. A ball is hoisted on a pole at the end of the old pier by day, when there is 15 feet water at the pier-head.
- Tides.** It is high water at Penzance, full and change, at 4h. 30m.; springs rise $16\frac{1}{2}$ feet, neaps, $12\frac{1}{2}$ feet.
- Pilots.** There are 16 Trinity pilots at Penzance who have no vessel, but are supposed to be always on the look-out for ships on the heights, or in their boats.
- Battery and Gear Rocks.** The Battery Rocks extend about 2 cable-lengths S. S. W. from the southern arm of the south pier of Penzance Harbor. The Gear, which covers at one-third flood, lies upward of 4 cable-lengths S. by W. $\frac{3}{4}$ W. from the light-house, and is marked by a black nun-buoy. The marks for it are: the Roman Catholic chapel of Penzance, in line with the east end of St. Mary's church N. $\frac{1}{2}$ W.; and the middle of Trewarveneth clump of trees. W. S. W. $\frac{3}{4}$ W.
- Cressar, Raymond, Penzeath, and Hogus Rocks.** The shore at the head of Mount Bay, from Penzance to the bridge at Marazion, is low and flat, and composed of sand and shingle, which runs off from high-water mark to the Long Rock, a distance of nearly 2 cable-lengths. Nearly $\frac{3}{4}$ mile eastward of Penzance Harbor, and about $\frac{1}{3}$ mile from high-water mark, is the southern extremity of the Cressar Rocks, which cover at two-thirds flood; their western limit, only 4 cable-lengths eastward of the harbor, is marked by an iron beacon, painted red, and surmounted by a ball.
- The Raymond or Bloon Rock lies S. E. by E. $\frac{3}{4}$ E. upward of $\frac{1}{2}$ mile from the beacon on the Cressar Rocks and nearly $\frac{1}{2}$ mile from the shore, its northern extremity nearly touch-

ing Long Rock; it is also marked by an iron beacon, with a ball.

The beach eastward of the Long Rock extends a cable-length from high-water mark, and the shore to Mount St. Michael forms a bay, on the eastern side of which are the Penzeath and Hogus Rocks.

The Penzeath is a small patch lying $\frac{1}{2}$ mile eastward of the Long Rock, and $1\frac{1}{2}$ cable-lengths off shore, which covers at one hour's flood.

The Great Hogus is a rocky cluster lying upward of $\frac{1}{3}$ mile off shore between the Penzeath and the mount, and the Little Hogus, which covers at three-quarters flood, is about $\frac{1}{4}$ mile off shore between the Great Hogus and the Penzeath.

Venton chimney shaft in line with the end of the western pier of Mount St. Michael Harbor E. S. E. $\frac{1}{4}$ E. leads south of the Cressar and Raymond Rocks, and the shoals outside them in about 3 fathoms at low water.

Mount St. Michael is a conical islet about a mile in circumference and 263 feet high. The harbor, formed by two piers on the northern side of the mount, has an area of $2\frac{1}{2}$ acres, and a depth of 11 feet at high-water springs, and $7\frac{1}{2}$ feet at neaps. The entrance between the pier-heads is 124 feet wide. It faces the northeast, and has 16 feet water in it at high-water springs, and $12\frac{1}{2}$ feet at neaps.

Mount St. Michael Harbor.

The Guthen and Maltman Rocks must be avoided by vessels approaching St. Michael Harbor. The Guthen, with only 10 feet water, lies upward of a cable-length off shore W. N. W. from the castle on the mount. The Maltman is about a cable-length off shore, S. W. $\frac{1}{4}$ S. from the castle, and covers at one-quarter flood. On the eastern side of the mount, about 2 cable-lengths off shore and E. S. E. $\frac{3}{4}$ E. from the castle, is a small cluster of rocks awash at low water.

Guthen and Maltman Rocks.

Acton Castle in line with the hummock of Greeb Rock S. E. $\frac{3}{4}$ E. leads south of the Maltman, and the Virgin Mine in line with the highest hummock of the Great Hogus N. E. $\frac{3}{4}$ E. leads west of the Guthen.

About a mile to the southeastward from Mount St. Michael is the Greeb Rock, 24 feet above high water. Its outer extremity is nearly $\frac{1}{4}$ mile from the shore; a detached rock lies off it, and between it and the land are large masses of rock extending W. by S. from Maendu Point. Between

Mount St. Michael to Cuddan Point.

Greeb Rock and themount the coast forms a small bay, with several shoal patches in it; off its low and rugged shore the low-water rocks extend three-quarters of a cable-length, and $\frac{1}{3}$ cable-length without them, at the several points, lie detached rocks.

Between the Greeb and Cuddan Point the coast forms a bay, in the northern part of which is a cluster of rocks, covering at two-thirds flood, called the Bears; the outermost lies S. E. by E. $1\frac{3}{4}$ cable-lengths from the hummock of the Greeb.

From Maendu Point, which is high and rocky, the cliffs descend abruptly to a low shore, to the southward of which are the Perran Sands; and thence to within $\frac{1}{6}$ mile of Cuddan Point the shore is flat and rocky. The cliffs around Cuddan Point are high and rocky. To the northwestward of the point is a rock standing well out of the water, about 150 feet off shore, and $\frac{1}{3}$ cable-length to the southward of the extreme point is the Shag Rock, which barely covers at high water.

Stones Shoal. The Stones Shoal lies about $\frac{1}{2}$ mile S. S. E. from Cuddan Point, and is dry in two places at low-water springs. To pass north of this shoal, shut the mount tower in with Cuddan Point.

Mountamopus Shoal. Mountamopus Shoal lies about $\frac{3}{4}$ mile southward from Cuddan Point; is $1\frac{1}{2}$ cable-lengths long and nearly a cable-length broad, and has 5 feet on its shoalest part. Its southern edge is marked by a black buoy.

Carn Malloes Shoal. The Carn Malloes Shoal lies a half mile S. E. from the shoalest part of the Mountamopus, and is a rocky bank, with several 3-fathom patches.

Iron Gates. The outermost shoal off Cuddan Point is the Iron Gates, a small rocky patch of 4 fathoms, lying S. W. $\frac{1}{2}$ S. 2 miles from the point, with Acton Castle open eastward of the hummock of Cuddan Point N. E. $\frac{1}{2}$ N.; the hummock on the Old Lizard Head touching Rill Head S. S. E. $\frac{1}{2}$ E., and Mountamopus buoy N. E.

Welloe Shoal. Welloe Shoal lies $\frac{2}{3}$ miles S. W. $\frac{3}{4}$ W. of Rinsey beacon, and upward of a half mile from the cliff immediately below the beacon.

Great Row Shoal. The Great Row Shoal has three fathoms on it, and is surrounded by foul and rocky ground. It lies upward of a mile S. W. by W. from the Welloe, with Trewavas farm-

house in line with the south gable of Rinsey Mine counting-house N. E. by E., and Perranuthno church-tower on with the inner saddle of the Cuddan N. by W.

Trithal engine-house, in line with the Roman Catholic chapel at Penzance N. by W., leads a mile westward of the Iron Gates.

Directions.

Rogers Tower, (Castle-an-Dinas,) on with the Mount St. Michael tower N. $\frac{1}{2}$ W. westerly, leads through between the Iron Gates and Mountamopus in 6 to 10 fathoms.

Madron Union, on with the Roman Catholic chapel at Penzance N. N. W. $\frac{3}{4}$ W., leads southwest of the Great Row Shoal; and Trigoning hill open eastward of Trewavas farmhouse N. E. $\frac{1}{4}$ E., leads southeast of it.

Ludgvan Church, in line with the Mount St. Michael tower N. $\frac{1}{2}$ E., or Acton Castle open westward of Cuddan Point N. E., leads westward of all the shoals off Cuddan Point; and Trigoning signal-hill, open eastward of the town of Trewavas, leads eastward of them.

From Cuddan Point the cliffs do not vary until near the Ynys Rock, $\frac{3}{4}$ mile to the eastward, whence they gradually decrease in height to the low point near the coast-guard station in Prussia Cove, which lies between the Ynys and Hoe Point. The cliffs from the coast-guard station to Hoe Point are 65 to 50 feet high, and terminate in the bight which forms the northwest part of the Pra sands. From the eastern limit of Prussia Cove to the end of the cliffs a series of high, detached rocks extends some distance off shore; those off Hoe Point lie nearly a cable-length from the cliff. The land to the eastward continues low for $\frac{3}{4}$ mile, forming a small bay bordered by the Pra sands, from the southeastern end of which the cliffs rise again and continue with little variation from Rinsey Head, 80 feet above high water, to Trewavas Head, which slopes seaward to a cliff 35 feet high. From Trewavas Head to Port Leven, about $1\frac{3}{4}$ miles, the cliffs rise to about 150 feet.

Cuddan Point
to Port Leven.

A rocket apparatus is kept at Prussia Cove.

Rocket apparatus.
Port Leven.

The entrance to Port Leven is 240 feet wide between the end of the pier and the Deazle Rocks, which dry $2\frac{1}{2}$ feet at low-water springs. The distance between the outer pier-heads is 134 feet, and the gates at the inner pier-heads are 32 feet wide.

The depth between the end of the pier and the Deazle

Rocks is 6 feet at low-water springs; and on the gate-sill there is $13\frac{1}{2}$ feet at high-water springs and 10 feet at neaps. The area of the port is about 5 acres, and it is dry at low water.

Life-boat.

A life-boat is stationed at Port Leven.

Tides.

It is high water full and change at Port Leven at 4h. 33m., springs rise $18\frac{1}{2}$ feet, and neaps 15 feet.

Port Leven to
Lizard Head.

From Port Leven the coast is low to Loo Pool, a deep inlet blocked up by a bar of shingle 34 feet above low water, about a mile south of Port Leven, for which it has sometimes been mistaken.

Farther to the southward the cliffs vary from 50 to 200 feet in height, the shore between continuing sandy to within $\frac{2}{3}$ mile of Pedngwinion Head; and thence to Pradanack Point the cliffs are 100 to 200 feet high, and the low-water rocks extend about $\frac{1}{2}$ cable-length off shore. Mullion Island, $\frac{1}{4}$ mile northeast of Pedncrifton Point, rises 118 feet above high water, and is precipitous on its W. N. W. side. There is good anchorage on its northwest side, in strong easterly or southeasterly gales, in about 10 fathoms, with the island bearing S. $\frac{1}{2}$ E., and Mullion church E. $\frac{3}{4}$ S.; but every preparation should be made to weigh if the wind shifts to the westward. From Pradanack Point to Lizard Head the cliffs are 200 to 250 feet in height. About $\frac{1}{2}$ mile southeastward of Rill Head and close in shore is Kynance Island, within which to the eastward is Kynance sandy cove.

Life-boat.

There is a life-boat at Mullion, near the island.

Boa Shoal.

The Boa is a rocky shoal of 6 fathoms, on which the sea breaks heavily in southwest gales. From it Rill Head bears E. $\frac{3}{4}$ S. $1\frac{1}{2}$ miles; Lizard Head S. E. by E. 3 miles; the eastern Lizard light-house is in one with Old Lizard Head, S. E. by E.; and the eastern extremity of Mullion Island is in line with Pedncrifton Point, N. E. $\frac{1}{2}$ N.

Directions.
Mount Bay.

In approaching the coast between the Land's End and Lizard Head, from the offing, the soundings decrease with tolerable regularity, the bottom being coarse sand, interspersed with whole and broken shells.

If bound into Mount Bay from the westward, to avoid the Runnelstone keep Godolphin Hill (which rises to the height of 532 feet about 4 miles westward of Helstone) open of Carndu Point, bearing about E. $\frac{3}{4}$ N.; and as that point is approached, Mount St. Michael must be opened south of it

to clear the Buck Rocks. When abreast Carndu Point keep Tetterdu Point well open south of the Carn Barges to avoid the Lelland, after which the shore may be approached to a distance of $\frac{1}{4}$ mile. After passing St. Clement's Island, bring Trithal engine-house in one with York house N. $\frac{1}{4}$ W., and it will lead eastward of the Low Lee and Carn Base Rocks, and direct to the anchorage in about 9 fathoms, with the tower on Mount St. Michael in line with St. Hilary church spire bearing E. ; and the beacon on Gear Rock N. by E. $\frac{3}{4}$ E. The best anchorage for coasters is farther to the westward in Gwavas Lake, in about $4\frac{1}{2}$ fathoms, with St. Clement's Island shut in with Penlee Point.

In approaching the bay from the southward, when between Carndu and Cuddan Points, and proceeding in the line toward Gulval at the head of the bay, the soundings will gradually decrease from 20 to $9\frac{1}{2}$ fathoms at low water. In the latter depth, which is nearly $1\frac{1}{4}$ miles from the shore, haul to the westward for the anchorage.

At night the bright light on Penzance pier will open out from the western coast of Mount Bay when entering from the westward. Run to the eastward till the red or green light (red or green according to the depth of water at the pier-head) comes in sight.

The western limit of the red or green light is an excellent mark to vessels bound into the bay from the westward, as it leads eastward of the Low Lee and Carn Base Rocks, which have only 4 feet water on them. It is also serviceable as a mark when beating up for Penzance, for by tacking on its western limit a vessel will avoid all danger on the western side of the bay, and by tacking on its northern limit she will avoid the foul ground off the Raymond, or Bloon, and Cressar Rocks, in the northern part of the bay.

Entering from the eastward, after rounding the Lizard and the Boa Shoal, if there is much ground-swell on, bring the red (or green) light to bear N. by W. $\frac{1}{2}$ W. before standing for it, by which means the Iron Gates Shoal will be avoided, for at such times the sea breaks heavily upon that and the Boa Shoal. In fine weather the seaman must use his own discretion when hauling to the northward, and it will only be necessary to remark that the westernmost of the Lizard lights kept in sight bearing S. E. by S. will lead south of the Iron Gates and up to St. Clement's Island.

CHAPTER III.

LIZARD HEAD TO START POINT.

- Lizard Head.** Lizard Head is a bold and precipitous promontory, visible from a distance of about 24 miles, and easily distinguished by its two white light-houses. The rocks in its vicinity extend off about a half mile. A life-boat is stationed at Polpear Point, about a cable-length westward of the light-houses.
- Life-boat.**
- Lizard lights.** The light-houses on Lizard Head are 61 feet high and 74 yards apart W. by N. and E. by S. They each exhibit a fixed bright light visible in clear weather from a distance of 21 miles. The eastern light is 229 feet, and the western light 232 feet above the level of high water, and in one they lead $3\frac{3}{4}$ miles south of the Manacle Rocks, and the same distance south of the Wolf Rock.
- Tides.** It is high water, full and change, at Lizard Head at 5h. 0m.; springs rise $14\frac{1}{2}$ feet, neaps $10\frac{1}{2}$ feet.
- The Stags.** The rocks commonly called the Stags, lying off the Lizard, are the Mulvin, the Man-of-War, the Carligga, and the Maenheere, to the southwestward and southward; and within the latter to the northward lie the Crenval and Ennach. They extend off nearly a half mile from the coast and have from 5 to 9 fathoms close to and among them; within them are masses of detached rock nearly joining the shore. The outer rocks cover at from half to three-quarters flood.
- Beast Point.** The promontory next east of Lizard Head is Beast Point. It is considerably higher than the Lizard lights, and limits their range of visibility in-shore to the eastward.
- Vroque Rock.** There are two red beacons on Beast Point 8 feet high and 96 yards apart; in line bearing N. W. they lead over the Vroque, a rock with 6 feet water, 4 cable-lengths S. E. from Beast Point. From the rock, Ruan Minor church-tower is in line with the western ridge at the entrance to Cadgwith, N. by E. $\frac{1}{2}$ E.; and the beacon on the Balk is in one with the middle hummock (whitewashed) on Hot Point, N. by W. westerly.

The Balk Beacon in line with the extremity of Hot Point, N. W. $\frac{1}{2}$ W. leads a cable-length northeast of the Vrogue; and Polpear Point open of the Bumble, W. N. W. leads the same distance to the southward.

The Sperran Shoals are rocky patches of 5 fathoms lying eastward of the Vrogue. From the eastern or outer patch, the Lizard lights bear W. N. W. $\frac{3}{4}$ W. nearly $1\frac{1}{2}$ miles, the top of the western light-house just showing south of the eastern one; Hot Point bears N. W. $\frac{1}{4}$ W. $\frac{3}{4}$ mile; and Treleague House is in line with the western face of Cadgwith Cliff N. $\frac{1}{4}$ E. Sperran Shoals.

Craggan Rock lies S. $\frac{1}{2}$ W. nearly $\frac{3}{8}$ mile from Cadgwith Cove and has 5 feet water on it. Beast Point bears S. W. by W. nearly a mile from it; Landewednack church W. southerly; and Treleague House is in line with the western face of the entrance to Cadgwith. Craggan Rock.

A small rock called the Va, which dries 3 feet at low water, lies about 2 cable-lengths S. E. $\frac{3}{4}$ E. from the extremity of the Balk, off Perran Vose Cove.

The land between Lizard Head and Start Point is, generally speaking, moderately high, and, being for the most part double, exhibits a great variety of elevation to a vessel in the offing as she changes her position. It also contains many deep openings between Helford and Looe, which at a distance seem to destroy the connection. About $9\frac{1}{2}$ miles northeast from the entrance to Falmouth, Dodman Point stands out boldly to seaward; it is a precipitous bluff 300 feet high, declining gradually to the westward, its steep face being toward the east. Lizard Head to
Start Point.

Gribben Head, to the westward of Fowey and just east of the deep bight of Polkerris, is distinguished by a beacon tower 84 feet high on an elevation 250 feet above high water; thence to Looe the land continues high and irregular, rather declining toward Whitesand Bay, but rising again in the vicinity of Plymouth.

Abreast of Plymouth Sound, about 6 miles from the land the streams are very irregular. About $1\frac{3}{4}$ hours before high water at Devonport the stream makes to the eastward, and runs for an hour about E. by S.; during the next hour it is scarcely sensible, after which it turns to the southward, gradually changing to W. S. W. till the last quarter ebb on shore, when it veers from W. S. W. to W. N. W. During the Tidal streams.

first three hours' flood on shore, its direction changes from W. N. W. to N. W., when it begins to slacken and set about N., till at three-quarters flood it runs E. by S. as at first. The maximum velocity of either stream does not exceed $1\frac{1}{2}$ knots.

Four miles southwest of the Eddystone the stream begins to run E. by S. when it is high water at Devonport, and continues about $2\frac{3}{4}$ hours, when it slacks and shifts to the southward. At three and a half hours ebb on shore it sets W. S. W.; at four hours W. by N.; and then W. N. W. until low water. During the first two hours' flood on shore the stream sets N. W. by W.; and loses its strength during the third hour, running N. W. and N. During the fourth hour what little stream there is sets N. N. E. and N. E.; and then E. N. E. and E. by N. till about high water, when its direction is E. by S.

Between Rame Head and Bolt Tail 4 miles off shore, the western stream begins at 8h. 40m. full and change, or 3 hours after high water on shore; and the eastern stream at 2h. 40m., or 3 hours after low water. The velocity of each stream does not exceed $1\frac{1}{2}$ knots, but they occasionally sweep past projecting points of the coast at the rate of 2 knots.

From Bolt Tail to Start Point at 4 miles off shore, the eastern stream makes 3 hours after low water, and the western stream 3 hours after high water on shore; they set along the land with a maximum velocity $2\frac{3}{4}$ knots. At neaps the turn of the stream is irregular, varying from 4 to 7 hours after high and low water on shore, the average being 5 hours. Its rate at neaps is $1\frac{1}{2}$ knots; off Start Point $2\frac{1}{2}$ knots.

South of the Stags there is always an extensive rippling on both streams of tide, stretching out seaward two or three miles from the rocks; this is chiefly occasioned by the unevenness of the ground, and when it blows strong from seaward during spring tides the sea is short and violent.

There is another extensive race or rippling to the south-east of Lizard Head, but it is occasioned by the confluence of the tides. At two hours' ebb the stream at the Manacles begins to run to the S. W., where meeting with the stream out of the bight between Cadgwith and Black Head, which sets to the eastward from half ebb to five

hours flood, they unite and set to the southeast; but at two hours' flood the stream at the Manacles again begins to turn, and the southeast direction is warped more easterly, till at high water it ceases altogether.

Godolphin Hill in line with Pradanack Point, or Pradanack Point open westward of Rill Head N. $\frac{1}{4}$ W., leads $\frac{1}{2}$ mile westward of the Stags; and Ynys Head, or the beach at Kennack Cove, kept in sight eastward of Beast Point about N. E., leads nearly $\frac{1}{2}$ mile eastward. But to avoid all shoal water off the Lizard, keep Godolphin Hill open of Rill Head N. $\frac{1}{4}$ W., until Lowland barn opens of Black Head N. E. by E.

Directions.
Lizard Head to
Start Point.

The course from Lizard Head to Start Point is about E. $\frac{3}{4}$ S., and the distance 63 miles. By not standing into less than 42 fathoms, a vessel will pass at least 5 miles south of the Eddystone. In the stream of the Eddystone there is from 34 to 37 fathoms; the ground in the former depth consists of coarse and fine sand, but in the latter a sort of dark-greenish muddy sand, which extends nearly 10 miles in a westerly and 4 miles in a southerly direction from the rock. From the western extremity of this muddy sand the steeple of Rame church appears open westward of the summit of Rame Head, and Loo Island bears N. N. E. $\frac{3}{4}$ E.

Proceeding eastward from the Lizard at night, the lights kept just in sight south of Beast Point, about W. $\frac{1}{4}$ N., will lead $1\frac{1}{2}$ miles southward of Black Head, and direct to the Eddystone. In thick weather Lizard Head should not be approached within 47 fathoms, which will be found 6 or 7 miles distant from it.

Between Lizard Head and Kennack Cove the cliffs, from 160 to 200 feet high, terminate in a low sandy bight; they then rise abruptly to 200 feet, and so continue to Black Head, which is 218 feet above high water. Housel, Perran Vose, Cadgwith, and Beagle Coves, on this part of the coast, are resorted to by coasters in strong northerly winds.

Lizard Head to
the Manacles.

Between Beast Point and Coverack Cove the shore is bordered with outlying rocks, which extend from 1 to 2 cable-lengths off shore. A small rock, called the Bo, lies in the entrance to Cadgwith, and covers at one-quarter flood.

From Black Head to Chynhals Point, which projects to

the eastward and is elevated 92 feet above high water, the cliffs are about 200 feet high; thence to Lowland Point they are only 10 to 20 feet high, with a ridge of land rising abruptly to 300 feet at the back.

Coverack Cove. Coverack Covelies between Chynhals and Lowland Points, and affords shelter for coasters with winds from S. W. to N. E. The best anchorage is in about 4 fathoms, with the end of the pier bearing W. S. W. $\frac{1}{2}$ W. $\frac{1}{4}$ mile. The harbor within the pier has an area of $1\frac{1}{2}$ acres with an entrance 70 feet wide. The depth is 12 feet at high-water springs, 8 feet at neaps, and it is dry at low water.

Tides. It is high water, full and change in Coverack Cove at 4 h. 35 m.; springs rise $14\frac{1}{2}$ feet, neaps $11\frac{1}{2}$ feet.

Manacle Rocks. The cliffs from Lowland Point to Manacle Point are 20 to 50 feet high, and the shore is composed of large boulders to the north side of the bight, but thence it is studded with high detached rocks. Off this part of the coast are the Manacles, a dangerous group of rocks about 3 miles E. N. E. from Black Head, and S. E. $\frac{1}{2}$ S. upward of $\frac{3}{4}$ mile from Manacle Point; and numerous rocks lie off Lowland and Manacle Points. The Manacles all cover at high-water springs, except Carndu, the southwesternmost rock, which is 5 feet above that level; from it, Maentenoweth Rock, the northernmost of the group, which covers at one-third flood, bears N. by E. $\frac{1}{4}$ E. $\frac{2}{3}$ mile. The outer or eastern rocks, named the Penwin and Vase, bear from each other N. N. E. and S. S. W. $\frac{1}{2}$ cable-length, with 6 fathoms water between them. The Penwin or outer rock is awash at low water, and from it Carndu Rock bears W. by S. about $\frac{1}{2}$ mile; the Little Wrea is seen between the Carndu and Inner Maen Vose, W. by S. $\frac{1}{4}$ S.; and Mawnan church is in line with the high-water mark on Nare Point N. $\frac{3}{4}$ E. The marks for the Vase, which has 4 feet water, are the extremity of Black Head in line with Inner Maen Vose Rock W. S. W. $\frac{1}{2}$ W., and St. Keverne church spire, in line with Wingoes Rock, N. W. by W. $\frac{1}{2}$ W.

Buoy. A black bell-buoy, with staff and ball and the word "Manacles" on its head, is moored in 20 fathoms water, about $\frac{1}{2}$ cable-length southeastward of the Penwin, with Mawnan church tower touching the first rise of Nare Point, N. $\frac{3}{4}$ W.; the light-house on St. Anthony Point, N. E. by N.; Black Head, W. S. W.; and St. Keverne church spire, N. W. by W. $\frac{1}{4}$ W.

Coverack coast-guard watch-house opens south of the Wrea Rocks W. $\frac{3}{4}$ S., leads $\frac{1}{2}$ cable-length south of the Manacles; but in proceeding toward these dangers from the Lizard, keep Beast Point open of Black Head, W. by S., until the square tower of Mawnan church, which stands on a hill on the north side of the entrance to Helford River, appears well open northeastward of the lowest extremity of land at Nare Point, N. $\frac{3}{4}$ W. westerly. A vessel will be northward of all the rocks when the houses on the southern side of Porthoustone Cove open, W. N. W. $\frac{1}{4}$ W.

Directions.

At night keep the Lizard lights in sight to the southward of Beast Point, W. $\frac{3}{4}$ N., until the St. Anthony fixed light bears N. N. E.

There is a passage inside the Manacles, between the Maentenoweth and the outermost low-water rock of the Verwin, which bear E. by S. and W. by N. from each other, distant a little more than one cable-length, but coasters in taking it from the southwestward must keep close to the southeastern extremity of the Carclase Rocks off Manacle Point, and, after passing them, bring the Little Wrea in one with their outer extremity, S. W. $\frac{1}{4}$ S., which will lead in the fairway between the Maentenoweth and the low-water rocks to the south southeast of the Verwin.

Approaching from the northeastward, bring Little Wrea Rock in one with the southeast extremity of Carclase Rocks S. W. $\frac{1}{4}$ S., and on nearing the latter steer so as pass about $\frac{1}{4}$ cable-length from their eastern side. This passage should not be attempted by strangers.

Close to the northward of Manacle Point is Porthoustone Cove, a small bight open to the eastward; on its northern side of entrance is a ledge of rocks extending $\frac{3}{4}$ cable-length off shore.

Manacles to
Helford River.

Two detached low-water rocks lie upward of a cable-length off shore S. $\frac{3}{4}$ E. and S. S. E. $\frac{1}{2}$ E. from Pendera Head, and S. E. by E. from it, 2 cable-lengths off shore, is a small shoal with $2\frac{1}{2}$ fathoms on it.

From Polkerris Point to Nare Point the land slopes abruptly to the cliffs, and between them is Porthalla Bight, which is exposed to the eastward. The low-water rocks extend upward of a cable-length off the head of this bight, and thence to Nare Head, which is $\frac{1}{4}$ mile southward of Nare Point; the shore is bordered by masses of de-

tached rocks. Vessls anchor in Porthalla Bight, with westerly and northwesterly winds, in 8 fathoms, stony ground, about $\frac{1}{2}$ mile from shore, with Manacle Point bearing S. $1\frac{1}{2}$ miles. There is a clean shingly beach at the head of the bight where, in the event of urgent necessity, a vessel may run on shore at an hour's ebb.

Close to the southward of the entrance to Helford River is Gillan's Creek, $1\frac{1}{2}$ cable-lengths wide, with a rock nearly in mid-channel, which dries a foot at low-water springs. The thatched house on the southern shore near Flushing, open, bearing W. $\frac{1}{4}$ S., leads close to the northward of the rock, and the same house shut in leads to the southward. Within Erra Point there is 2 feet at low-water springs.

A vessel may anchor, with westerly winds, $\frac{3}{4}$ mile off shore, in 6 to 9 fathoms, anywhere between Manacle Point and Nare Head.

Directions. To clear the southeastern side of the low-water rocks extending E. $\frac{1}{4}$ S. a cable-length from Nare Point, keep St. Keverne church well open of Nare Head S.W. $\frac{1}{4}$ S., and to clear their northern side keep the house in Flushing, which is on the southern shore of Gillan's Creek, open of Erra Point W. by S.

Helford River. Between Nare Point and Rosemullion Point is the entrance to Helford River, which may be recognized by Mawnan church, on a hill on the north side, and by Little Dennis Castle on the south side. The depth decreases gradually in ascending the river for $1\frac{1}{2}$ miles to a bar on which there is usually 8 to 12 feet at low water. The small vessels that frequent the river generally lie off the town of Helford, about 2 miles from the entrance.

Directions. Vessels entering this river may obtain the assistance of Falmouth pilots, who are always cruising about the locality. In entering, be careful to avoid the Gedges Rocks, which lie $\frac{1}{4}$ mile from the northern shore of the entrance, and cover at one-third flood. Bosahan Point, kept open of Mawnan Chair Point W. N. W. $\frac{3}{4}$ W., leads south of them; the tower of the Meteorological Observatory at Falmouth, open of Pennance Cliff N. N. E. $\frac{3}{4}$ E., leads eastward; and a vessel will be westward of them when the Carndu or highest Manacle Rock is in line with the high-water mark on Nare Point S. $\frac{1}{4}$ W. After passing the Gedges, give the shore on either side of the river a berth of a good half cable-length until abreast of Dourgan, when the white house of Cala-

mansack kept just touching the northern point of Porth Navas, N. W. by W. $\frac{1}{2}$ W., will lead up to the anchorage in 4 fathoms, mud bottom, the Old Ferry house bearing N. $\frac{3}{4}$ E.

From Rosemullion Head to Pennance Point the cliffs are 20 to 50 feet high, and half way between the points is a sandy cove called Maen Porth. From Pennance Point to Pendennis Point the coast is irregular, the cliffs continue about the same height, and the low-water rocks, which are shelving, extend nearly a cable-length off shore. Within the bight to the northward of Pennance Point is a deep inlet with a space of retained water named Swan Pool.

Helford River
to Falmouth.

Falmouth Harbor affords capacious and secure anchorage and may be easily recognized by the light-house on St. Anthony Point, at the eastern side of the entrance, and by Pendennis Castle on an elevation 233 feet above high water on the western side. The entrance is a mile wide and is divided into two channels by Black Rock, which lies E. by S. $\frac{1}{3}$ mile from Pendennis Point. The eastern channel, that between Black Rock and the light-house, is wider and deeper than the other; with the wind at E. a vessel can sail in free on the starboard tack, and at W. N. W. on the port tack.

Falmouth.

The western channel is only $2\frac{1}{2}$ cable-lengths wide; it can be navigated by vessels of great draught at half tide; with the wind at N. W. by W. a vessel will sail in free on the port tack, and although the high land of Pendennis may cause it to baffle, there will be no danger when she has shot within the Black Rock.

The harbor extends to the northward as far as Pill Creek, nearly 4 miles from the entrance, and its shores are indented by several land-locked inlets.

The town and port of Truro is about $4\frac{1}{2}$ miles above Pill Creek.

On the southern shore of the harbor, about $\frac{1}{2}$ mile from the town, is an outer harbor between piers, also a gridiron and two graving-docks, the larger of which is 400 feet long, 65 feet wide at entrance, with 17 feet over sill at springs. The pier harbor has an area of 42 acres and an entrance 500 feet wide facing the northeast. The channel leading to it has a depth of 18 feet at low water or 34 feet at high-water

springs, and there is 22 feet at low-water springs along the wharves of the eastern breakwater.

Life-boat.

A life-boat is stationed at Falmouth.

Falmouth light.

The white stone light-house, 62 feet high, on St. Anthony Point, exhibits at an elevation of 72 feet above high water a revolving light which shows a bright face every 20 seconds, and should be visible from a distance of 13 miles in clear weather. Coming from the eastward the light will open out on a N. W. $\frac{1}{2}$ N. bearing, and thence it will be seen round seaward and up the harbor. From the same tower a fixed bright light is shown 37 feet below the former; it is seen from seaward only when bearing between N. by E. $\frac{1}{4}$ E. and N. N. E. $\frac{1}{2}$ E., and the western limit of visibility leads 2 cable-lengths to the eastward of the Manacles. During fogs a bell is sounded.

A fixed green light, 27 feet above high water, is shown from the end of the eastern breakwater of the pier harbor, and is visible from a distance of 3 miles.

Magnetic variation.

The magnetic variation at Falmouth in 1870 was $22^{\circ} 8'$ W., decreasing at the rate of $7'$ annually.

Tides.

It is high water full and change at 4h. 57m.; springs rise 16 feet, neaps 12 feet. The ebb sets out of the harbor S. S. W. to the distance of a mile from the entrance, when it runs to the S. W., and farther off to the W. S. W. and W. by S. Off the Manacles the stream runs to the westward nearly 3 hours after low water on shore.

At Truro it is high water full and change at 5h. 5m.; springs rise 10 feet, neaps 6 feet.

Old Wall.

The Old Wall is a pinnacle rock, steep-to, with 27 feet water on it, from which the light-house on St. Anthony Point bears N. $1\frac{1}{4}$ miles. Restranguet smelting-house chimney is in line with the eastern extremity of the broken rocks off St. Anthony Point N. $\frac{1}{4}$ W., and Greeb Point just shows east of Killygerran Head N. E. $\frac{1}{2}$ E. The pinnacle is so small that the lead falls off it into 5 and $5\frac{1}{2}$ fathoms; within it are a number of 4-fathom patches of rocky, uneven ground, extending nearly to the shore and causing considerable over-fall, especially with S. E. winds and a flood tide.

Black Rock.

Black Rock lies N. W. $\frac{1}{4}$ W. nearly $\frac{3}{4}$ mile from St. Anthony Point and covers at about half flood; its position is indicated by a conical stone beacon, surmounted by a mast and ball. The 3-fathom line extends $1\frac{1}{2}$ cable-lengths E. S. E. $\frac{1}{2}$ E. from

Black Rock, and two patches of 17 feet lie respectively S. S. E. 1 cable-length and S. W. $\frac{1}{2}$ S. $1\frac{1}{2}$ cable-lengths from it; within the rock, toward the spit of Falmouth Bank, are some patches of 20 feet.

Lugo Rock lies $\frac{3}{4}$ mile northward of St. Anthony Point and S. S. W. $1\frac{1}{4}$ cable-lengths from St. Mawes Castle. It uncovers 2 feet at the lowest tides, and from it Mawnan church just shows north of the beacon on the Black Rock W. S. W. A black buoy is moored 50 yards south of it.

Lugo Rock.

St. Mawes Bank, or Flat, borders the eastern side of Falmouth Harbor, and nearly a mile northward of St. Mawes Castle it stretches half-channel over. The northwestern extremity, named the Vilt, is steep-to, and is marked by a black buoy. A black buoy is also moored on the 5-fathom line of this bank, on the eastern side of the Narrows, N. W. $\frac{1}{2}$ N. from the castle.

St. Mawes Bank.

Falmouth Bank, or Flat, extends from Pendennis Point to Mylor Point, and fills up the whole of the western part of Falmouth Harbor. Its outer or eastern edge forms the western side of the Narrows, and is marked by a white buoy on its 5-fathom line $1\frac{1}{2}$ cable-lengths from the east buoy of the Narrows.

Falmouth Bank.

Governor Rock is a detached 2-fathom patch, about a cable-length within the edge of Falmouth Bank, and is marked by a checkered black and white can-buoy, which lies E. by S. 60 yards from it, with the east end of Falmouth dock breakwater touching the pier at Flushing N. W. $\frac{1}{4}$ N. and Black Rock beacon S. $\frac{1}{4}$ E. $\frac{1}{2}$ mile.

Governor Rock

There is good anchorage in 10 to 12 fathoms outside the entrance to Falmouth, about a mile S. W. by W. $\frac{1}{2}$ W. from St. Anthony Point, but no sailing-vessel should anchor farther eastward than to bring St. Mawes pier in line with Carricknath Point, nor farther westward than Mesack Point in one with Black Rock beacon; nor farther off than to have Penare Head just open of Killygerran Head E. N E., or Budoc church in line with the middle of Swan Pool sandy bay N. N. W. $\frac{3}{4}$ W. In any position within the space just marked out she may, on the wind veering to the eastward and rendering it an unsafe anchorage, either proceed to sea or run into the harbor. Small vessels cross over Falmouth Bank and anchor between the town and Trefusis Point, in

Anchorages.

about two or $2\frac{1}{2}$ fathoms at low water, or lie aground alongside the quays.

The usual anchorage for ships of war or large vessels is in Carrick Road between St. Mawes and Falmouth Banks, the best position being in the northern part of the road in from 13 to 15 fathoms mud. If the wind is east of south, bring up with port anchor in 12 or 13 fathoms rather inclined toward St. Mawes Bank, and moor with starboard anchor toward Falmouth Bank in 12 fathoms. Should the wind be west of south, bring up with starboard anchor inclined toward Falmouth Bank, and moor with port-anchor toward St. Mawes Bank. Keep the hawse open, for southerly winds throw in much sea.

Cross Road and St. Just Pool, though inconveniently far from Falmouth, afford better shelter and anchorage. Bring up in Cross Road with either bower in 10 to 14 fathoms, mooring with open hawse to the westward.

Pilots

In the Falmouth district between Lizard Head and Dodman Point, there are 13 pilot cutters and 40 Trinity pilots, 20 of whom are entitled to take charge of vessels drawing 17 feet and upward.

Directions.

Bound to Falmouth from the westward at night, keep the Lizard lights open south of Beast Point, W. $\frac{3}{4}$ N., until St. Anthony *fixed* light bears N. N. E.; then steer for the light on that bearing, and having passed about $\frac{1}{4}$ mile westward of St. Anthony Point, a N. $\frac{1}{4}$ E. course for $1\frac{1}{2}$ miles will lead to Carrick Road.

In the day-time Beast Point, kept open of Black Head, W. by S., will lead $\frac{3}{4}$ mile south of the Manacles. When St. Anthony light-house bears N. N. E. steer for it on that bearing till Killiganoon house comes on with Penarrow or Mylor Point, N. $\frac{1}{4}$ E., which will lead through the eastern channel and the Narrows into Carrick Road.

If desirous of anchoring in St. Just Pool, proceed on until Budock church comes over the rising ground of Trefusis Point, or until the tower of the meteorological observatory is just open south of Falmouth church, about W. by S.; either of these marks will lead through Cross Road, until St. Keverne church comes over Pendennis Point, S. W., when anchor in St. Just Pool in 12 to 15 fathoms mud.

If the weather be hazy, and these marks cannot be seen, give St. Anthony Point a berth of $\frac{1}{4}$ mile and run in, keep-

ing the land at St. Mawes about a point on the starboard bow, and then steer for Mylor Point. Do not approach the land of St. Mawes nearer than two cable-lengths, nor St. Mawes Bank within the depth of 9 to 8 fathoms. In beating in give the rocks off St. Anthony Point a good berth, and if the ship is of great draught do not approach Black Rock within $1\frac{1}{2}$ cable-lengths.

Entering the harbor by the western channel, keep midway between Pendennis Point and the 17-foot patch lying $1\frac{1}{2}$ cable-lengths S. W. $\frac{1}{2}$ S. from the beacon on Black Rock; and when the beacon and light-house are in line steer for St. Mawes castle until Killiganoon house comes on with Mylor Point, N. $\frac{1}{4}$ E., when proceed as before.

To work out of this harbor, large vessels should weigh on the latter part of the flood, or a little before high water, and before half ebb they will be out of the harbor and half way to the Manacles. As the ebb sets to the westward, toward Helford River, a vessel when clear of the entrance should not stand farther westward than the meridian of Pendennis Point, keeping the entrance open for the benefit of the harbor tide.

Gerran Bay, between Killygerran Head and Nare Head, is $3\frac{1}{2}$ miles wide and $1\frac{1}{2}$ miles deep, and the soundings from 15 fathoms in the offing gradually decrease to the shore. Gerran church stands on the western side of the bay, and its spire, 254 feet above high water, may be seen from the offing. From Killygerran Head the cliffs are only 20 to 40 feet high as far as the eastern side of Pendowa beach at the head of Gerran Bay, whence they gradually rise to Nare Head; at low water the rocks dry a cable-length off shore.

Gerran Bay.

Nearly a mile northeast of Killygerran Head is Greeb Point, off which shoal water, with $3\frac{1}{2}$ to 7 fathoms, extends in a south-easterly direction nearly a mile, where it terminates in a shoal of $3\frac{1}{2}$ fathoms, called the Bizzies, from which Trewince house is in line with the east end of Roseteage house, N. W., and the white coast-guard house in Vryan Bay is on with the southeast extremity of Gull Rock, N. E. by E. $\frac{3}{4}$ E. Trewince house, open west of Roseteage house, N. W. $\frac{3}{4}$ W., leads westward of the Bizzies; open east of Roseteage, N. W. by W. westerly, it leads eastward of them; and the white coast-guard house open southeast of Gull Rock, N. E. by E. $\frac{1}{2}$ E., leads to the southward.

Veryan Bay. Nare Head is a bold headland 260 feet above high water, and Veryan Bay, which lies between it and Dodman Point, is $4\frac{3}{4}$ miles wide and $1\frac{1}{2}$ miles deep; the shore is clifty, from 20 to 200 feet high, and forms a number of bights.

Gull Rock. Gull Rock, 125 feet above high water, lies S. E. by E. 6 cable-lengths from Nare Head, and $\frac{1}{4}$ mile off shore, with a clear passage between it and the land, the least depth being 20 feet.

The Whelps. The Whelps are detached rocks lying S. W. $\frac{1}{4}$ S. from Gull Rock. The outer and highest Whelp is 3 cable-lengths from Gull Rock, and covers at three-quarters flood; between it and the middle Whelp, which is $1\frac{1}{2}$ cable-lengths from Gull Rock, there is a passage of $3\frac{1}{2}$ fathoms water; both rocks may be approached to within $\frac{1}{2}$ cable-length. A small rock, which covers at one-quarter flood, lies S. W. 100 feet from the outer Whelp, and from it Pendowa lime-kiln is seen touching Nare Head, N. W. by N. This lime-kiln open west of Nare Head, N. N. W. $\frac{1}{2}$ W., leads westward of the Whelps; and Porth Looe flag-staff open southeast of Gull Rock, N. E. $\frac{1}{4}$ N., leads to the southeast.

Lath Rock. Off the fishing-village of Porth Looe, and E. $\frac{3}{4}$ N. about $1\frac{1}{2}$ miles from Gull Rock, is a small rock called the Lath, with only 7 feet on it and deep water around. It lies with Gerran church in line with the extremity of Nare Head, W., and Porth Looe flag-staff N. N. W. $\frac{3}{4}$ W. Gerran church about half way between Nare Head and Gull Rock, W. $\frac{1}{4}$ N., leads southeast of the Lath; to pass in-shore of it keep the church shut in with Nare Head.

Dodman Point to Chapel Point. Dodman Point is a prominent headland 363 feet above high water; the soundings are irregular for the distance of a mile between S. by E. and S. W. by S. from it, varying from 10 to $5\frac{1}{2}$ fathoms, and cause heavy overfalls in bad weather; it will be prudent, therefore, when passing the point at such times to give it a berth of 2 miles, where the sea will be regular and the depth 30 fathoms. The marks for the shoalest water, $5\frac{1}{2}$ fathoms, are, Gerran church in line with the highest Whelp, W. $\frac{3}{4}$ N., and the flag-staff on Dodman Point, N. by W.

The coast from Dodman Point trends to the eastward $1\frac{1}{4}$ miles to Lanledra Point, which is 20 feet high, and between them is a bight around which the cliffs are about 100 feet in height. A group of rocks, which covers at one-quarter flood,

extends E. by S. $1\frac{1}{2}$ cable-lengths off Landedra Point, and is called the Western Oar. Here the coast turns abruptly to the northward, forming a bight, and then eastward to Chapel Point, which is low. In this bight the cliffs are high, sloping seaward, and in its western corner is a small sandy cove, called Gorran Haven, having on its southeast side the remains of a pier, off which vessels anchor, with winds from W. S. W. to W., in 5 or 6 fathoms.

Gwineas Rock, E. N. E. 2 miles from Dodman Point, and S. $\frac{1}{2}$ W. $\frac{3}{8}$ mile from Chapel Point, is 26 feet above high-water springs, and appears black. The Yaw, which dries 3 feet at the lowest tides, is S. E. by E. $\frac{1}{4}$ E. $1\frac{1}{2}$ cable-lengths from Gwineas Rock. The passage between Gwineas Rock and Turbot Point, which is $\frac{1}{2}$ mile S. W. from Chapel Point, is narrowed to $\frac{1}{3}$ mile by a rocky patch of 11 feet, S. S. E. a cable-length from Turbot Point. The channel between this patch and Gwineas Rock has a depth of 5 to 7 fathoms.

The coast from Chapel Point turns abruptly to the north-west, and at the distance of $\frac{3}{8}$ mile is the sandy cove of Portmellin, in which there is a small fishery establishment; $\frac{1}{4}$ mile farther north is an inlet, at the head of which is the harbor and town of Mevagissey.

Mevagissey Harbor has an area of about $3\frac{1}{2}$ acres, with an entrance 106 feet wide between the pier-heads, and a depth of $14\frac{1}{2}$ feet at high-water springs, and 10 feet at neaps, in the center of the harbor, and $15\frac{1}{2}$ to 11 feet in the entrance. It affords good shelter to vessels that can lie aground, but during southeast gales a great run sets in, causing them to strike heavily in taking the ground. The bottom dries $1\frac{1}{2}$ cable-lengths outside the pier-heads at the lowest tides.

It is high water, full and change, in Mevagissey Harbor at 5h. 4m.; springs rise $15\frac{1}{2}$ feet, neaps 12 feet.

From Mevagissey the coast trends in a northeasterly direction half a mile to Pen-nare Point, and then north the same distance to a sandy beach, which extends across a bight, in which is Pentuan tidal basin. The entrance is secured by gates 28 feet wide, the sill of which is $2\frac{1}{2}$ feet above low-water ordinary springs. They are protected from the southward by a pier running off about 177 yards to the southeast from them, and are further secured by balks of timber during southeast gales. The basin has a depth of 14 feet at

Gwineas and
Yaw Rocks.

Mevagissey
Harbor.

Tides.

Pentuan²¹

high-water springs, and 10 feet at neaps. A vessel should never attempt to run for it with a gale blowing on the land, or with a ground-swell on. The shore from Pentuan again becomes clifly and bends round to the eastward about $1\frac{1}{2}$ miles to Black Head, which is bold and steep-to.

Anchorage.

Vessels will find good shelter from southwest gales in the bight of Mevagissey Bay in 7 to 10 fathoms, sandy bottom. They will also lie well sheltered in St. Austell Bay, by anchoring in its southern part off Rope Hawne, in 6 fathoms, stiff clay. Tywardreath Bay affords shelter from easterly gales in 5 fathoms, sandy bottom, between Polkerris Harbor and Little Gribbin Point.

Charlestown Harbor.

Charlestown Harbor, between two piers, in the northern part of St. Austell Bay, has an area of one acre, an entrance 53 feet wide, and is capable of accommodating 15 vessels of 150 to 200 tons burden. At its head there is a small tidal basin $\frac{3}{4}$ acre in extent, secured by gates 27 feet wide. There is 14 feet between the pier-heads and over sill of basin, at high-water springs, and 10 feet at neaps.

Par Harbor.

Par Harbor is formed by two piers in the northeast part of Tywardreath Bay, and has an area of $26\frac{1}{2}$ acres. The entrance is 125 feet wide and has 14 feet water at high-water springs, and 10 feet at neaps, which depths continue all through the channel of the harbor along the inner pier. At the lowest tides the sand dries out to the Callyvardor Rocks, which lie S. by E. $\frac{1}{4}$ E. $\frac{1}{3}$ mile from the outer pier-end; these rocks have an iron beacon on their western extremity, are 500 feet in extent, and cover at one-third flood.

Polkerris Harbor.

Polkerris Harbor, S. E. $\frac{3}{4}$ mile from Par Harbor, has an area of $\frac{1}{4}$ acre, and a depth of $14\frac{1}{2}$ feet at high-water springs and 10 feet at neaps.

Gribbin Head; Daymark.

Gribbin Head may be easily recognized by a square beacon-tower 84 feet high, with red and white horizontal stripes, which stands 250 feet above high water. The head is bordered with rocks, on which the sea breaks heavily in bad weather. Cannis Rock lies S. E. $\frac{1}{2}$ E. from the beacon, and $\frac{1}{4}$ mile off shore; it covers at three-quarters flood, and there is a narrow passage with 9 feet water between it and the land. Off Little Gribbin Point, the southeast extremity of Tywardreath Bay, the rocks extend nearly a cable-length.

Fowey Harbor.

Fowey Harbor is at the entrance of the river Lostwithiel, which trends to the northward and is navigable at high-water

for $5\frac{1}{2}$ miles toward the town of Lostwithiel. The entrance, which is about $1\frac{1}{2}$ miles eastward of the beacon on Gribbin Head, is little more than a cable-length wide, and may be recognized by the high land on either side, and more particularly by the ruins of St. Savior's church on the eastern side, which stands at an elevation of 195 feet, and the old mill on the high ground on the western side, 245 feet above high water. The town of Fowey stands on the right bank of the river, $\frac{1}{2}$ mile within the entrance; and the village of Polruan in a small height just within the eastern point of entrance. The shores are well wooded for a long distance above the town.

The direction of the entrance to this harbor gives it an advantage over many others on the coast, as outward-bound vessels can leave it with a S. by E. wind, and coasters embayed between Dodman Point and Rame Head during a heavy southerly gale may run for it even without anchors; for having passed the eastern point of the entrance, and rounded Polruan Point, they may run on the bar, which is of soft mud and has 3 to 5 feet of water on it at the lowest tides. From this position they will be released by the flowing tide, and can run as far up as may be convenient.

There is room for four vessels of 16 feet draught to moor in Polruan Pool, $\frac{1}{4}$ mile within the entrance; and though it appears on the chart to be exposed to southwest gales it is not so, there being no swell between the points of entrance. Thirty vessels of 18 feet draught and moderate length may also lie moored above the bar, quite land-locked.

There is a life-boat and a coast-guard station at Fowey.

Life-boat.

The magnetic variation was $22^{\circ} 8'$ W. in 1870, diminishing at the rate of $7'$ annually.

Magnetic variation.

It is high water, full and change, in Fowey Harbor at 5h. 14m.; springs rise 15 feet, neaps $11\frac{1}{2}$ feet.

Tides.

To clear the Cannis Rock when approaching Fowey from the westward, keep Dodman Point showing south of the Gwineas Rock, W. S. W. $\frac{1}{2}$ W., until the beacon on Gribbin Head comes in line with the coast-guard flag-staff N. by W. $\frac{1}{4}$ W., or Fowey church-tower is in line with St. Catherine Point N. E. by E.; then bring the church-tower in line with White House Point, N. E. $\frac{1}{2}$ E., which will lead through the entrance to an anchorage in Polruan Pool.

Directions.

Coming from the eastward, steer parallel with the shore, at a distance of about a mile, until Fowey church-tower is in line with White House Point, when proceed as before. There is no danger off either point of entrance that is not visible except Mundy Rock, which lies a cable-length within the entrance on the western side, with 5 feet on it at the lowest tides.

In the roadstead outside the entrance there is good anchorage in 5 to 8 fathoms, sandy bottom, with Fowey church showing over St. Savior's Point, and the points to the eastward open.

Fowey to Pol-
perro.

The coast from Fowey trends in an E. S. E. direction nearly 4 miles to Nealand Point, and between them are Lantic and Lantivet Bays separated by Pencarro Head, 265 feet above high water; the cliffs vary from 50 to 300 feet in height, and the rocks uncover nearly a cable-length off shore.

The Udder Rock lies a half mile off the eastern shore of Lantivet Bay, and uncovers 2 feet at the lowest tides. The northern extremity of Looe Island in line with Orestone Rock, E., or the coast-guard flag-staff at Polperro in line with the cliff, E., will lead a half mile south of Udder Rock; and a vessel will be eastward or westward of it when the beacon on shore abreast the rock is east or west of Shag Rock.

Larrick Rock lies W. $1\frac{1}{2}$ cable-lengths from Nealand Point, and covers at last-quarter flood; Shag Rock kept open of Lyson Point, N. W., will lead south of it; so will Black Bottle Rock open of Pencarro Head, N. W. by W. $\frac{3}{4}$ W. From Nealand Point, which is remarkable for its overhanging cliff, the coast trends eastward $1\frac{1}{2}$ miles to Downend Point, and the rocks extend a cable-length off shore.

Polperro Ear-
bör.

A mile eastward of Nealand Point is the mouth of a little inlet 160 feet wide, at the head of which is the fishing-town and tidal harbor of Polperro. The area of the harbor is 3 acres; it has an entrance 54 feet wide between the pier-head and the shore, and a depth of 11 feet at high-water springs, and 5 feet at neaps. The sand dries to a distance of 150 feet outside the entrance at the lowest tides, but beyond this the depth gradually increases to 20 feet. There is a rocky patch of 9 feet water lying nearly in mid-channel at the mouth of the inlet, and another called the Polca, of 4 feet, $\frac{1}{2}$ cable-length south of the former.

It is high water, full and change, at Polperro at about 5h. 4m.; springs rise $15\frac{1}{2}$ feet, neaps 12 feet. Tides.

The Downend Shoals, with 2 fathoms over them, lie $\frac{1}{4}$ mile off Downend Point; and thence the coast turns to the north-east, and then bends to the southeast to Orestone Point, forming Talland Bay, which is a mile wide, and bordered by a number of rocky islets from 30 to 60 feet high. From Orestone Point the shore trends N. N. E. nearly $\frac{1}{2}$ mile, with cliffs from 30 to 60 feet high; and thence becoming much lower runs about east, and at low-water springs is nearly connected with Looe Island by flat shelving rocks. Looe Island is $\frac{1}{2}$ mile in circumference and 145 feet high; off its southeast extremity are the Renny Rocks which extend upward of $\frac{1}{4}$ mile in that direction and cover at one-quarter flood. Polperro to Looe.

Looe Harbor is 9 miles N. W. $\frac{1}{2}$ W. from Rame Head, and N. N. E. $\frac{3}{4}$ mile from Looe Island. The entrance is 150 feet wide, and there is 12 to 16 feet in the harbor at high-water springs, and 9 to 13 feet at neaps. At the lowest tides the bottom dries 67 yards outside the jetty. Looe Harbor.

There is a life-boat at Looe, which is also a coast-guard station. Life-boat.

The roadstead off Looe Harbor affords good shelter from westerly winds, and is only open from S. E. by E. to S. by W. The best anchorage is in 4 to 8 fathoms, mud, with the summit of Looe Island bearing from S. W. by W. to W., and the tower of East Looe church well open of the western point of the entrance to the harbor. Vessels of light draught may anchor farther in, in less water over sandy bottom, with East Looe church N. N. W. $\frac{1}{2}$ W. Roadstead.

The magnetic variation at Looe in 1870 was $22^{\circ} 8' W.$, decreasing at the rate of $7'$ annually. Magnetic variation.

It is high water at East Looe, full and change, at 5h. 26m.; springs rise 16 feet, neaps 13 feet. Tides.

When approaching Looe from the westward, the beacon on Gribbin Head in line with Nealand Point, W. N. W. $\frac{1}{4}$ W., will lead $\frac{1}{4}$ mile south of the Rennies Rocks, or the slated store-house on Downend Point just open south of the Orestone, W. N. W., will lead a cable-length south of them; and when the tower of East Looe church is well open of the western point of the entrance to the harbor, N. $\frac{1}{4}$ W., steer N. N. E. for the anchorage. Directions.

The passage between Looe Island and the main nearly dries at low-water springs, but at most other times there is a channel for boats and small coasters. To run through from the eastward keep Dodman Point just showing clear of Orestone Rock, W. $\frac{1}{2}$ S., and when the summit of the island bears S. E. haul to the southwestward to avoid the Kimlers Rocks, which cover at one-quarter flood.

Looe to Rame
Head.

About $2\frac{1}{2}$ miles eastward of Looe is Seaton Beach, and off it are several rocky patches of $4\frac{1}{2}$ fathoms, the outermost of which, named Sherbeterry Rocks, is 2 miles from the beach. From this patch the beacon on Gribbin Head is open of Nealand Point, W. N. W. $\frac{1}{4}$ W., and an old public-house is in line with a long hedge, N. by E. $\frac{1}{4}$ E. The Mewstone on with the extremity of Rame Head, S. E. by E. $\frac{3}{4}$ E., leads $\frac{3}{4}$ mile south of it, and clear of all danger between Rame Head and Polperro.

Longstone Rock, 59 feet above high water, lies close to the land, $4\frac{1}{4}$ miles from the entrance to Looe Harbor. The cliffs along this part of the coast are from 60 to 300 feet high, and the outlying rocks extend in some places upward of 2 cable-lengths off shore.

About $\frac{3}{4}$ mile eastward of the Longstone Rock is a small bight, at the head of which is the little pier harbor of Port Wrinkle, which affords shelter to fishing-boats. There are two channels into it between the rocks, and three beacons on the cliffs 400 feet to the northward, which are lighted by lanterns at night when the boats are at sea. The two western beacons in one, N. E., lead through the eastern channel, and the eastern and western beacons in line, E. N. E., through the western channel.

From Port Wrinkle the coast bends round to the southeast $4\frac{1}{4}$ miles to Rame Head, forming Whitesand Bay, which is exposed to the whole force of southwesterly gales. The coast is high and rugged, the cliffs varying from 100 to 250 feet in height, and is bordered by alternate patches of sand and rock, which extend upward of a cable-length from the foot of the cliffs; vessels should not approach it within the depth of 6 or 7 fathoms at low tide.

Coasters will find good anchorage with off-shore winds in the bight in the southeast part of this bay, in $3\frac{1}{2}$ to 4 fathoms, sandy bottom, with the two western points of the promontory of Rame Head in one, S. S. W. $\frac{1}{2}$ W.; a cable-

length from the northern of these points, with the coast-guard house in the bight touching the high-water mark of the point, is a detached rock called the Pader, which covers at a quarter flood. There are also detached rocks awash at low-water springs at the same distance off the southern point.

The Eddystone Rock is awash at high-water ordinary springs. Its northwest side is clear of danger, and there is 10 fathoms water $\frac{1}{2}$ cable-length from the light-house; but the other sides are foul, particularly the northeast side, which should not be approached within $\frac{1}{4}$ mile. A small patch called N. E. Rock lies E. by N. $1\frac{1}{2}$ cable-lengths from the light-house, which uncovers 2 feet at low-water springs; at $\frac{1}{2}$ cable-length to the N. N. E. the depth is only $3\frac{1}{2}$ fathoms. The other dangers extend respectively S. W. $\frac{1}{4}$ W. 240 feet, S. by W. 500 feet, and S. E. $\frac{3}{4}$ E. 490 feet from the light-house; the outermost rocks uncover from 3 to 7 feet, and close outside them are depths of 8 to 12 fathoms.

The light-house is a circular granite tower on Eddystone Rock, E. $\frac{1}{4}$ S. $38\frac{1}{2}$ miles from Lizard Head; S. W. $\frac{1}{4}$ S. $8\frac{1}{2}$ miles from Penlee Point; and W. N. W. $\frac{1}{4}$ W. 18 miles from Bolt Head. It is 89 feet high from base to vane, is painted red and white in alternate horizontal bands, and exhibits at an elevation of 72 feet above high water a fixed bright light which should be seen from a distance of 13 miles in clear weather.

It is high water, full and change, at the Eddystone at 5h. 15m.; springs rise 16 feet, neaps 12 feet.

The Hand Deepes lie N. W. $\frac{3}{4}$ N. $3\frac{1}{2}$ miles from the Eddystone light-house, nearly in the track of vessels bound to Plymouth from the westward. They are rocky pinnacles, on the highest of which there is only 4 fathoms at low-water springs, and should be carefully avoided by vessels of great draught in a high sea or a long swell. In bad weather their position is shown by a short breaking sea in their vicinity, and in fine weather by tide rippings. From the center of Hand Deepes the white signal-house on the high land in the rear of Rame Head is seen westward of the chapel on the head, N. E. by E. $\frac{1}{4}$ E.; Earl Morley's park gate-way is wholly in view eastward of the high land of Penlee; Mount Batten round tower is in line with Penlee Point; and the

eastern part of the Moor Hills is on with the sharp top of the Mewstone E. $\frac{3}{4}$ N.

The light-house on Plymouth breakwater in line with Penlee Point, E. N. E. $\frac{1}{2}$ E., leads upward of a mile north-westward of the rocks; and the light-house on with Mount Batten tower, N. E. by E. $\frac{1}{4}$ E., leads the same distance southeastward of them.

East Rutts.

The East Rutts is a cluster of rocks extending 2 cable-lengths in a northwest direction, and a cable-length wide, with 5 fathoms over it and 10 to 19 fathoms close to. It lies 5 miles off shore in the fairway of vessels bound to Plymouth from the eastward, with the first rise in the land within Prawl Point, seen half way down the Bolt Head, S. E. by E. $\frac{1}{2}$ E.; Bigbury church spire over the right extremity of the sandy beach in Challaboro' Cove N. E. by E. $\frac{3}{4}$ E.; the Mewstone N. by W. $\frac{3}{4}$ W., 7 miles; Bolt Head S. E. by E. $\frac{1}{2}$ E., about the same distance; and Eddystone light-house W. by N. $11\frac{1}{2}$ miles.

The peak of the Mewstone in line with Maker tower, N. N. W. $\frac{1}{2}$ W., leads nearly a mile eastward of these rocks; and the same peak in one with Stoke block-house, and the fall of the land at Reny and Staddon Points, leads 2 miles westward of them.

Plymouth Sound.

Between Rame Head and the Mewstone, which bears S. E. by E. $\frac{1}{2}$ E. $4\frac{1}{2}$ miles from it, is the entrance to Plymouth Sound, which affords capacious and secure anchorage for vessels of any size.

It is sheltered by a magnificent breakwater, and contains two good harbors, Hamoaze and Catwater, between which are three inlets, Stonehouse Pool, Mill Bay, and Sutton Pool, each about $\frac{1}{3}$ mile long.

Catwater, Sutton Pool, and Stonehouse Pool are chiefly resorted to by merchant-vessels and foreigners, Hamoaze being reserved for Her Majesty's ships.

Plymouth and the adjoining towns of Stonehouse and Devonport, at the head of the sound, with their suburbs, had in 1861 an aggregate population of 127,000.

Dangers outside the Breakwater.

The dangers at the entrance of Plymouth Sound outside the breakwater, are, the Draystone Reef on the western side; in the center the Knap, Panther, and Tinker Shoals, and for large vessels some patches of rocky ground lying off the east end of the breakwater; and on the eastern side

the reef off the Mewstone, the Shagstone, and rocks in its vicinity.

Draystone Reef projects nearly $\frac{1}{4}$ mile to the southeast from Penlee Point, and is marked by a checkered red and white buoy in 5 fathoms at its outer extremity, with Rame Head coast-guard mast on with the north side of a remarkable gap in the cliff in Lillery Cove, N. W. by W. $\frac{1}{2}$ W.; the west side of the third fish-store from the northward in Cawsand Bay on with Penlee high-water point, N. $\frac{3}{4}$ E.; and west end of harbor-master's house on with high-water mark of Redding Point. There is 11 feet over it at low water, and 19 feet between it and the point.

Should the buoy be adrift do not stand nearer the reef than to bring the tall sharp spire of the Roman Catholic church open of Redding Point, N. E. $\frac{1}{4}$ N.; this leads eastward of it.

The Knap and Panther Shoals constitute nearly a continuous shoal of sand and rock, having only 20 and 22 feet at low water over their shoalest heads, with casts of 5 to 7 fathoms between. The two combined extend upward of $\frac{1}{2}$ mile S. W. by W. $\frac{1}{2}$ W., and from the outer and shoalest spot on the Knap, with 20 feet water, the breakwater light-house is distant $\frac{1}{2}$ mile N. E. $\frac{1}{4}$ E. The passage between the light-house and the inner end of the Panther is 2 cable-lengths broad, and may occasionally be useful. The leading mark through is the Shagstone, in line with the northern high-water mark of the Mewstone, S. S. E. $\frac{3}{4}$ E.; the same mark will also lead north of the Tinker in not less than 4 fathoms.

The south end of Knap Shoal is marked by a black buoy in 6 fathoms, with the block-house on Devil's Point just open eastward of Ravenness Point, N. by E. $\frac{3}{4}$ E.; and the breakwater beacon on with the south end of Bovisand coast-guard houses, E. $\frac{1}{4}$ S.

There is also a black buoy on the north end of the Panther in 7 fathoms, with Mount Wise flag-staff in line with the western extremity of the breakwater platform N. $\frac{3}{4}$ E.; the breakwater beacon midway between Bovisand house and Bovisand cottages, E. S. E. $\frac{3}{4}$ E.; and the Shagstone its own breadth open northward of the Mewstone, S. E. by S. southerly.

Tinker shoal is $\frac{1}{4}$ mile long east and west, $\frac{1}{8}$ mile wide, Tinker Shoal.

has 15 to 20 feet water over it, and its center lies S. E. by S. about $\frac{3}{4}$ mile from the east end of the breakwater. There is a white buoy on each end of it, the western one being at the northwest angle of the shoal, in 6 fathoms, with the dock-yard chapel in line with Ravenness Point N. $\frac{1}{4}$ W.; the breakwater beacon on with the east end of Catdown quarry cliff, N. E. $\frac{1}{4}$ N.; and the highest peak of Reny Rock on with the right extremity of a small dark quarry on Wembury Point, S. E. by E.

The eastern buoy lies at the southeast angle of the shoal in 5 fathoms, with the breakwater light-house on with the east turret of Picklecombe Fort N. by W. $\frac{3}{4}$ W.; the house in Staddon high north battery on with the inner part of the curve of Bovisand pier-head, N. E.; and the highest part of Reny Rock on with the center of Wembury Point quarry, S. E. by E.

Between the Tinker Shoal and the east end of the breakwater are several rocky 4-fathom patches, two of which, near the middle of the eastern channel, are marked by black and white checkered buoys, sometimes termed the fairway buoys. The outer or southern buoy, near which is 26 feet water, lies with the Shagstone on with the peak of the Little Mewstone, S. by E. $\frac{3}{4}$ E.; and the breakwater beacon in line with the citadel flag-staff, N. N. E. The inner buoy has 25 feet near it, and lies with the breakwater beacon on with the citadel flag-staff N. N. E., and the breakwater light-house on with the game-keeper's cottage, Mount Edgecumbe, N. W. $\frac{3}{4}$ N.

Shagstone.

The Shagstone is a small square-headed rock about 9 feet above high water, lying N. N. W. $\frac{1}{2}$ W. 1 mile from the peak of the Mewstone, and $\frac{1}{6}$ mile from the Reny Rock, with a reef of detached rocks dry at low water between them. It is a conspicuous mark in the day-time, and is on the outer edge of a rocky ledge which skirts the shore between the Mewstone and Bovisand Bay. To the northward of the Shagstone as far as Andern Point, this ledge extends a half mile off shore, and its outer edge is marked by two red buoys, the southernmost of which is in $4\frac{1}{2}$ fathoms with the Shagstone on with the peak of the Mewstone, S. S. E. $\frac{1}{2}$ E., and the breakwater beacon on with the east end of Hoe quarry, N. by E. $\frac{1}{4}$ E. The northern buoy is in $5\frac{1}{2}$ fathoms, with the chapel on Rame Head on with the first hollow in

the cliff north of Penlee Point, W. by N.; and the breakwater beacon on with the boundary wall of West Hoe quarry, N. by E. $\frac{1}{4}$ E.

The Great Mewstone is a precipitous rocky islet 194 feet high, with scanty vegetation and a sharp apex, lying about $\frac{1}{2}$ mile S. S. W. from Wembury Point. The passage between is filled with rocky ledges, and has a narrow channel only available for boats. Great Mewstone.

The Little Mewstone is a dark rock 48 feet high, 100 yards southwestward of the Great Mewstone. Little Mewstone.

Mewstone Ledge runs out $1\frac{1}{2}$ cable-lengths southwest from the Little Mewstone, and its extremity is marked by a red buoy in $7\frac{1}{4}$ fathoms at low water, with the peaks of the Great and Little Mewstone in line, E. N. E.; the southwest end of Picklecombe fort in Mount Edgecumbe park touching the north side of the breakwater light-house, N. by W. $\frac{3}{4}$ W.; and the flag-staff on Mount Wise in line with the inner edge of the Shagstone. The Shagstone on with the breakwater beacon, N., leads nearly 2 cable-lengths westward of this reef. Mewstone Ledge.

The Queen's Grounds consist of several patches of rock, with $3\frac{1}{2}$ to 4 fathoms water, about midway between Picklecombe Point and the breakwater light-house. A red buoy is placed in 5 fathoms on their southeastern extremity, with Devil's Point block-house in line with Redding Point, N. by E. $\frac{3}{4}$ E.; and the peak of the Mewstone on with the west crane on the breakwater, S. S. E. $\frac{1}{4}$ E. The ground on the west side of the sound is generally unfit for anchorage, being hard and rocky. Dangers inside the breakwater; Queen's Grounds.

The New Grounds is a rocky shoal with a depth of 29 feet on its shoalest part, half a mile N. E. from the breakwater light-house. New Grounds.

A red buoy is moored on the south side of it, with the east building-shed in the dock-yard just open eastward of trees on Wilderness Point; the tall engine-house chimney in the dock-yard just clear of Wilderness high-water point, N. $\frac{3}{4}$ W.; and St. John's church, Plymouth, on with lower part of the retreating angle in the citadel wall, just within Fisher's Nose, N. E. $\frac{3}{4}$ E.

Duke Rock lies near the western limit of a bank which extends off shore between Staddon and Ram's Cliff Points. There is a white buoy near it, in 5 fathoms, N. N. E. $\frac{1}{2}$ E. Duke Rock

about $\frac{1}{3}$ mile from the breakwater beacon, and nearly the same distance from Bovisand pier-head, with the eastern high chimney in the victualing-yard on with the west high-water extremity of the islet lying off the north end of Drakes Island, N. by W. $\frac{1}{4}$ W.; the obelisk on the Hoe in line with Diamond Mark, N. by E. $\frac{1}{2}$ E.; and the south end of Bovisand cottages on with a tangent to the circular fort at Bovisand, S. E. The shoalest part of the rock is $\frac{1}{2}$ cable-length southeastward of the buoy and has 18 feet over it; there are 4 and 5 fathoms between the shoalest heads.

Dunstone Rock. Dunstone Rock lies W. 2 cable-lengths from Dunstone Point, on the east side of the sound; and from its shoalest head, which has 19 feet over it, Charles church, Plymouth, is in line with the west side of Fisher's Nose, N. by E. $\frac{1}{4}$ E.; and the obelisk on Mount Edgumbe is on with the north extremity of the fort on Drakes Island, N. W. $\frac{3}{4}$ W. There is 4 fathoms within and around the rock.

Melampus Shoal. Melampus Shoal is the southeastern extremity of the rocky ledges extending from Drakes Island. It is marked by a black buoy, from which St. Andrew's church tower, Plymouth, touches the west side of the obelisk on the Hoe, N. E. by N. easterly; St. John's chapel turret is on with the victualing-yard gate-ball; and the bakery chimney (the eastern one) in the victualing-yard is over the north-east cliff of Drakes Island.

The Bridge. The Bridge is a rocky reef or submarine causeway connecting Drakes Island with Redding Point. The deepest channel over it has 7 feet at low-water springs, and is marked by two beacon-buoys, the outer one being red, and the inner one white; they may be passed on either side, but very closely, as the channel is narrow. During bad weather, especially with a southerly wind and an ebb tide, the sea breaks heavily across the channel, and no boat or small craft should then attempt it after half ebb. The leading mark through is St. John's chapel, Devonport, in line with the block-house on Devil's Point, N. $\frac{1}{2}$ W. The cross-mark for the shoalest part of the channel is the southeastern extremity of the rampart on Drakes Island on with the southeast angle of the citadel.

Vanguard and German Rocks. The Vanguard and German Rocks are the highest heads of several rocky patches lying south from Devil's Point. The latter, which has $2\frac{1}{2}$ feet on it, is 146 yards from the

block-house on the point, and can only be in the way of small vessels. The south extremity of Staddon Point on with the high-water rocks south of Drakes Island, S. E., leads outside the German Rock and between it and the Vanguard.

The Vanguard, with 3 fathoms over it, lies nearly in mid-channel, and is much in the way of large ships going to or from Hamoaze; a black mooring-buoy in 5 fathoms marks its south side. From the shoalest head, with 3 fathoms on it, Mount Wise flag-staff is in line with the center of the tower on Devil's Point, N. $\frac{3}{4}$ W.; the victualing-office clock-vane is on with the west end of Western King fort, N. by E. $\frac{3}{4}$ E., and the camera-mast on the Hoe is on with the southwest angle of West Hoe terrace, E. $\frac{3}{4}$ N.

Drakes Island Flat is a bank of sand and mud, which extends half way from the north side of Drakes Island to the opposite shore. From its northern edge, in 4 and 5 fathoms at low water, the northeastern extremity of Wilderness Point is on with the southern extremity of Bottlenose Point, W. N. W. A black can-buoy in 10 fathoms marks its north-western limit, and from it Cremill obelisk is on with Wilderness Point; and the east end of Esplanade terrace is over the middle of West Hoe terrace.

Asia Shoal, at the northeastern extremity of the ledges extending off Drakes Island, is marked by a white buoy in 21 feet water, with the northwest and northeast buoys of the Winter Shoal in line with Mount Batten coast-guard flag-staff, E. S. E.; the camera on the Hoe on with the southeast angle of Esplanade terrace, N. E. $\frac{1}{4}$ N.; and Mount Edgcombe ruin on with the southeast extremity of the islet off the northwest end of Drakes Island, W. $\frac{1}{2}$ S.

Winter Shoal lies nearly midway between Drakes Island and Fisher's Nose, and has 10 feet on it. Between it and the island there is not more than $4\frac{1}{2}$ fathoms at low water, but eastward of the shoal there is 10 to 18 fathoms. Within the 3-fathom line it is nearly square, and about 120 yards across; there are three buoys on it. That on its northwest edge is striped red and white, and lies in 4 fathoms, with the chimney on Gills soap factory on with the northeast angle of West Hoe terrace, N. $\frac{3}{4}$ W.; Bank's house (yellow) in Queen Anne ship-yard on with the east angle of the citadel,

Drakes Island
Flat.

Asia Shoal.

Winter Shoal.

E. $\frac{3}{4}$ N.; and Mount Edgecumbe ruin in line with the south end of the barracks on Drakes Island, W. $\frac{1}{4}$ S.

On the northeast edge is a checkered red and white buoy in 5 fathoms, with Gills soap-factory chimney over the east end of the lime-kilns in West Hoe quarry, N. by W. $\frac{3}{4}$ W.; half of the coast-guard houses at Cawsand open of Redding Point, W. S. W. $\frac{1}{2}$ W.; and the south side of Buenos Ayres trees touching the north side of Batten Point coast-guard houses, E. S. E. $\frac{1}{4}$ E.

At the southern extremity of the shoal is a red buoy in 3 fathoms, with the north end of the Cawsand coast-guard houses touching Redding Point, W. S. W. $\frac{3}{4}$ W.; the chimney of Gills soap factory just open westward of the lime-kiln, and over the east end of the counting-house of West Hoe quarry; and the obelisk at Cremill Point on with the end of the grass on Bottlenose Point, N. W. by W. $\frac{3}{4}$ W.

Mallard Shoal. Mallard Shoal lies south of the citadel, and directly in the fairway to Catwater; the least water on it is 12 feet, and there is 5 and 6 fathoms on all sides. Its northwest extremity is marked by a black buoy in 7 fathoms, with the Cawsand coast-guard houses just in sight over Redding Point W. S. W. $\frac{1}{2}$ W.; and the obelisk on Mount Edgecumbe in line with the second embrasure of Western King fort, W. N. W.

Cobbler Shoal. Cobbler Shoal is the western extremity of a rocky ledge extending off Mount Batten, and its outer limit is marked by a black buoy in $2\frac{1}{2}$ fathoms, with Devonport monument on with the southwest extremity of the wall on West Hoe terrace point, N. W.; and the southernmost of two tall chimneys at Catdown its own breadth open of the quay on Mount Batten Point, E. $\frac{1}{4}$ N. Northeast of the buoy $\frac{1}{2}$ cable-length there is only 6 feet water.

Breakwater. The northeastern part of Plymouth Sound is protected by the breakwater, an immense structure of granite and limestone. Its western extremity is about 2 cable-lengths northward of the Panther Shoal, and it extends eastward toward Bovisand Bay, terminating about $3\frac{1}{2}$ cable-lengths from Stadon Point.

Beacon. On its eastern end is a conical beacon bearing a mast with a ball at the top. The mast has steps, and the ball is fitted to contain six men in case of shipwreck.

Light-house. On the western end of the breakwater is a circular gran-

ite tower 76 feet high, which exhibits at an elevation of 63 feet above high water a fixed light which shows red from Staddon Point, E. S. E. $\frac{1}{2}$ E. from the light, round seaward to the direction of the Melampus buoy, which lies N. E. $\frac{1}{2}$ E. from it.

Over the anchorage within the breakwater it shows bright, and no vessel should anchor till it changes from red to bright.

This light should be visible from a distance of 9 miles in clear weather.

A fixed bright light 15 feet below the red one in the same tower serves as a leading light for the western channel. It is visible between the Draystone and Knap Shoal, bearing from N. E. $\frac{1}{2}$ E. to N. E. by E. $\frac{3}{4}$ E., and when seen the channel is open.

Greenwich mean time is shown daily, except on Sundays, by the instantaneous collapse of a black canvas cone on the flag-staff of the redoubt on Mount Wise, Devonport. When not in use the cone remains closed on the staff.

Time signal.

As a preparatory notice it is extended into conical shape at 3 minutes before 1 o'clock, and at the instant of 1h. p. m., Greenwich mean time, it collapses. It is again extended 2 minutes later, and collapses a second time at 1h. 5m. p. m.

The cone is suspended on the flag-staff below the flag at an elevation of 175 feet above the sea, and may be seen with a glass in clear weather from a considerable distance outside the breakwater, when bearing from N. by W. to N. by E. Mount Wise may be known by its green southern slope; also from its proximity to St. Stephen's church, which has a remarkably sharp spire. The flagstaff is in lat. $50^{\circ} 22' N.$, lon. $4^{\circ} 10' 15''$, or 16m. 41 sec. W. from Greenwich.

The magnetic variation was $21^{\circ} 58' W.$ in Plymouth Sound in 1870, decreasing at the rate of $7'$ annually.

Magnetic variation.

At Devonport dock-yard it is high water, full and change, at 5h. 43m.; springs rise $15\frac{1}{2}$ feet, neaps $11\frac{1}{2}$ feet. At the breakwater it is high water about a quarter of an hour earlier than at the dock-yard. The range of tide is greatly influenced by the wind; southerly gales raise the water 2 to 3 feet above its ordinary level, and strong northerly winds cause a corresponding depression.

Tides.

The tides are tolerably regular in Plymouth Sound, run-

ning each way about six hours, and following the trend of the shores; on an average the turn of the stream takes place half an hour after high and low water on shore. The greatest velocity at the entrance and in the sound is about $1\frac{1}{2}$ knots; and in the harbor $2\frac{1}{2}$ knots. The flood runs up fair between Asia and Winter Shoals, tending rather to set over the former. From Vanguard Rock it sets toward Barn Pool, and thence turns toward the fair channel and runs for Mount Wise; after which it takes the fair course of the harbor. The ebb runs from Mutton Cove toward Devil's Point, and sets with great strength over Vanguard Rock. The eddies within the rock and off Devil's Point are very strong.

Anchorage.

Cawsand Bay, on the westside of the sound, affords good anchorage to vessels bound down channel and detained by westerly winds, being sheltered from S. W. $\frac{3}{4}$ W. to S. E. by E. $\frac{1}{2}$ E. They should anchor south of the line of the central part of the breakwater; northward of it the ground is rocky. If of great draught, keep Drakes Island open of Redding Point, and anchor abreast the village of Cawsand, in 5 to 7 fathoms, fine sand, mud, and small shells. Smaller vessels will find the soundings regular, with sandy bottom as they approach the shore. Water and ordinary supplies may be obtained at the villages of Kingsand and Cawsand.

The best anchorage in Plymouth Sound is within the triangle formed by the following intersections: Penlee Point in line with the west end of the breakwater; the center of Cawsand in line with the west end of the breakwater; and St. John's Church, Plymouth, in line with the west extremity of Mount Batten. In this space there is from 30 to 45 feet at low-water springs, over soft mud. By admiralty regulations Her Majesty's ships are required to occupy the anchorage-ground near the breakwater, and merchant-vessels are to anchor in the northeast part of the sound. This latter anchorage is limited to the southward by the two whitewashed marks on Ram's Cliff Point in one, S. E. by E. $\frac{3}{4}$ E.; and to the westward by the Hoe obelisk and east end of Windsor terrace in line, N. by E. $\frac{1}{2}$ E.

Small vessels frequently anchor on the flat north of Drakes Island, westward of a line joining the Asia and Melampus buoys, and southward of the transporting buoys on the

north side of the island, in 3 to 8 fathoms, mud, sand, and gravel.

Moorings for one ship of moderate length are laid down in Barn Pool, on the west side of the passage into Hamoaze.

The land in the neighborhood of Plymouth Sound may be recognized by Rame Head, 335 feet high, of a conical form as seen from the southward, with a small ruined chapel on its summit; by the spire of Rame Church; the turreted beacon on Penlee Heights, 35 feet high; the breakwater and light-house; the large towns and forts about the sound; the high wall of the rifle-butt on Staddon Heights; the Great and Little Mewstones; and other conspicuous objects. A remarkable feature of the soundings, which will materially assist in determining a ship's position in thick weather, is that a depth of 20 fathoms at low water extends parallel with the shore $\frac{3}{4}$ mile outside Rame Head, the Mewstone, and Stoke Point, and $2\frac{1}{4}$ miles outside the breakwater. Thirty-two Trinity House pilots belong to the port; their limits are Looe and Start Point.

Directions.

There are two entrances into the sound, the western channel, between the red buoy of the Queen's Grounds and the western end of the breakwater; and the eastern channel, between the eastern end of the breakwater and Staddon Point. The former is nearly a half-mile wide, and carries from 6 to 9 fathoms at low water; the latter has 5 fathoms, and a breadth in some places of not more than 80 yards.

The western channel is the only entrance that can be used by large vessels with safety at all times of tide. Bound through it from the westward, after passing Rame Head keep a good quarter of a mile off shore, and do not attempt to round Penlee Point until Mount Batten tower is in line with the breakwater light-house, N. E. by E. $\frac{1}{4}$ E.; this mark will clear the Draystone and lead up toward the western end of the breakwater, to which give a berth of a cable-length in rounding and then haul to the northeast for the anchorage.

Western channel.

In working through the western channel, when standing toward the Draystone do not open Mount Batten tower westward of the light-house. When northward of the line of Stoke Point on with high-water mark on the north point of the Mewstone, S. E. $\frac{1}{4}$ E., in standing toward the Knap

and Panther Shoal do not open the tower to the eastward of the light-house.

When standing toward the Queen's Grounds avoid shutting in the east end of Esplanade terrace with the east end of Drakes Island; and in working along the south side of that island keep the whole of Cawsand open of Redding Point.

Cawsand Bay may be ranged by the lead alone; in working through, however, if the ship is of great draught, do not approach within $\frac{1}{4}$ mile from its southern shore, nor stand farther westward than to bring the west side of Drakes Island touching Redding Point. After passing the line of the breakwater, or the light-house and beacon in one, keep a good half-mile off shore.

A vessel from the eastward intending to enter by the western channel, and being about a half-mile outside the Little Mewstone, with the breakwater beacon and Shagstone in line—which is the clearing-mark for Mewstone Ledge—should steer so as to pass outside Knap Shoal, the fore clearing-mark for which is Maker church in line with Gamekeeper's cottage, N. $\frac{1}{2}$ W.; and the back mark, the north high-water line of the Great Mewstone in line with Stoke Point, S. E. $\frac{1}{4}$ E. After passing the Knap Shoal she should proceed as above directed.

At night bring the Eddystone light-house to bear S. W. $\frac{1}{4}$ W., and keeping it in that direction astern run boldly in until the red light in the breakwater light-house is seen, which will be right ahead if the bearing of the Eddystone has been preserved. Having made the red light, steer for it on a N. E. by E. $\frac{1}{2}$ E. bearing until the bright leading light in the same light-house is seen, when the channel will be open, and keeping the bright leading light in sight run directly for it. After rounding the breakwater haul to the northeastward, but do not anchor till the red light has fully changed to bright, which it will do when it bears S. W. $\frac{1}{2}$ W.

Eastern chan-
nel.

The eastern channel into the sound should not be attempted at night, nor at any time by vessels of great draught, unless with a free wind or with steam, because of the numerous rocks which are scattered in its vicinity, and the occasional scend or depression of the sea there, with southwesterly and southeasterly winds. The channel is marked by buoys, the passage between which, as already

remarked, is in some places very narrow, but free from danger.

The obelisk (painted with red and white horizontal bands) on the Hoe in line with the breakwater beacon, N. by E. $\frac{3}{4}$ E., leads through between the Tinker and Shagstone, and between the shoals on either hand, directly to the east end of the breakwater, in not less than 5 fathoms at low water. After rounding the breakwater at the distance of a cable-length from the beacon steer to the northwest for the anchorage, taking care to avoid Duke Rock.

There is a channel between the breakwater and the shoal patches of the eastern channel, which is frequently used. It is about $\frac{3}{4}$ cable-length wide, and not less than 5 fathoms will be found in it at low water, with the flag-staff on the eastern part of Bovisand pier ranged from edge to edge of the north tower of Staddon Fort. To sail through, keep the flag-staff in line with the center of the north tower, E. N. E. $\frac{3}{4}$ E. This channel is also useful to vessels bound westward with scant westerly winds, when, owing to the crowded state of the sound, they have not room to make their boards to the westward.

Small vessels well acquainted with the place generally run through the eastern channel at night, by keeping Sutton Pool pier-light just open of Batten Point; but no stranger should attempt it, as the light is not easily distinguished from those of the town.

When running into or out of the sound in the day-time upon any of the before-mentioned leading marks, bear in mind that so long as Bolt Head is in sight south of the Mewstone the vessel will be without, or southward of, all the shoals; and that Bolt Head shut in with the Mewstone ranges closely upon the tails of both the Tinker and Knapp. When entering the sound from the eastward do not approach the Mewstone nearer than half a mile, till the breakwater beacon is in one with the Shagstone, bearing about N., which will lead 2 cable-lengths westward of the Mewstone reef in 11 fathoms.

Catwater forms the entrance to the river Plym, and is a well-sheltered harbor, 190 acres in area, with a general depth of 2 to 3 fathoms. There is a narrow channel of $3\frac{1}{2}$ fathoms leading to a deep hole near the Turnchapel Rock, where moorings are laid down and 16 large ships can moor in

Catwater.

tiers at low water. There are building-yards, patent slips, and a dry-dock on its shores; the latter is 190 feet long, 57 broad, 45 feet wide at entrance, 14 feet over sill at high-water springs, and $9\frac{1}{2}$ feet at neaps.

Directions.

There are two 4-fathom channels leading to Catwater, one between the Mallard and Cobbler Shoals, keeping the spire of St. John's church, Plymouth, in line with Fisher's Nose, N. E. $\frac{1}{2}$ E.; and the other between Mallard Shoal and the citadel, keeping Ravenness ruin on Mount Edgecumbe between the two barracks on the west end of Drakes Island, W. $\frac{1}{2}$ S. The latter leads up to the mark for the best water to Turnchapel docks, which is St. Andrew's church tower, Plymouth, in line with the lamp on the west pier-head of Sutton Pool, N. N. W. $\frac{1}{2}$ W.

As the anchorage space is usually filled with vessels, which prevent the leading marks from being followed, it is not prudent for a stranger to enter without a pilot.

Sutton Pool.

Sutton Pool is near the entrance of Catwater, and its upper part is inclosed by piers. The width between the pier-heads is 350 feet, and the depth 22 feet at high-water springs. On the east pier-head is a self-registering tide-gauge, over which is a dial-plate, which shows at all times the actual depth between the pier-heads. Within the pier-heads there is not more than 6 feet at low water, and the greater part, consisting of soft mud, dries. There are building-yards, patent slips, and a dry-dock on the shores of the pool; the latter is 265 feet long, 54 feet broad, and 50 feet wide at entrance, with 16 feet over the sill at high-water springs, and $11\frac{1}{2}$ feet at neaps.

Light.

A bright gas-light, visible 5 miles, is exhibited 25 feet above high water on the west pier-head of Sutton Pool. It is larger and brighter than any of the town lights. Red gas-lights are shown at most of the principal landing places in the harbors.

Mill Bay.

Mill Bay, at the head of the sound, has a wet and dry dock, and a tidal basin.

The tidal basin is protected by a pier from the east point of the entrance, within which is a pontoon-pier for the accommodation of steam-vessels; it has an area of 30 acres and a depth of $2\frac{1}{4}$ to 14 fathoms at high-water springs, and $1\frac{3}{4}$ to $12\frac{1}{2}$ fathoms at neaps.

The wet-dock is 1,260 feet long, 450 feet broad, 80 feet

wide at entrance, 31 feet over sill at high-water springs, and $26\frac{1}{2}$ feet at neaps. The dry-dock is within the wet-dock, and is 367 feet long, 92 feet broad, 80 feet wide at entrance, $27\frac{1}{2}$ feet over sill at springs and 23 feet at neaps.

There is a red light on the pier-head at Mill Bay, and a green light on the pontoon; these lights in line clear the Melampus Shoal. Light.

Hamoaze is the lower part of the river Tamar, between Mount Edgecumbe and Albert Bridge at Saltash, and its deep-water space is fully taken up with moorings for Her Majesty's ships. Its entrance is somewhat contracted and circuitous, but it contains space sufficient for 100 sail of the line at moorings, besides anchorage for small vessels in moderate depth of water, with good holding-ground, well sheltered from wind and sea. At the quays of Devonport, and in the rivers and creeks that have their outlet in Hamoaze, a considerable coasting trade is carried on. The government dock-yards, &c., occupy a water-front of more than a mile on the eastern shore, and the Royal William victualing-yard is on a tongue of land on the eastern side of the entrance. Hamoaze.

Stonehouse Pool lies between the towns of Stonehouse and Devonport, and at its entrance, off the victualing-yard, there is 5 to 20 fathoms at high water; a short distance farther up the muddy bottom dries at low water. Stonehouse Pool.

Cremill Shoal is a spit running off from Cremill Point, and its northeast extremity is marked by a black conical buoy in 5 fathoms. The breakwater light-house open of Ravenness Point, S. $\frac{3}{4}$ W., until the first building at South-down is open of Cremill Point, W., clears its eastern side. Cremill Shoal.

Rubble Bank or Harbor Shoal is a ledge of slate rocks running off the southwest point of the dock-yard, fully half-way across the channel; there is 3 fathoms over its shoalest head, named the Pollock Rock; the western end of the shoal is marked by a black buoy in 5 fathoms. Rubble Bank.

Devonport monument in line with the entrance to the mast pond, N. E. by E. $\frac{1}{4}$ E., leads eastward of Rubble Bank; the flag-staff at the northwest angle of the victualing-yard in line with the western or brewery chimney of the same yard leads southward; and the dock-yard chapel tower open north of the master-attendant's office, N. E. by E. $\frac{1}{4}$ E., leads to the northward of it.

Directions—
Hamoaze.

Two channels lead into Hamoaze, one carrying 12 to 15 fathoms between the Winter and Mallard Shoals, the other 4 fathoms between Winter and Asia shoals. Gills soap-factory chimney ranged from end to end of West Hoe terrace marks the limits of the channel between the Winter and Asia Shoals, and this passage is generally taken by large vessels, except at dead low-water springs; for although the other is deeper, the turning is sharp and there is difficulty in winding a long ship. A wind between E. and S. by W. will enable a vessel to lie through either channel into Hamoaze; and one between W. and N. by E. will allow her to proceed from Hamoaze to the sound without tacking, but it must be remembered that near half-flood the stream runs with great force, particularly between Cremill Point and Devil's Point, so that even in a steam-vessel great caution is necessary, and it is therefore not desirable to move a ship during the strength of the tide.

When proceeding through either of the above channels from the anchorage in the sound, steer so as to bring the obelisk on the Hoe in line with the diamond mark on a high-water rock below the Hoe, bearing N. by E. $\frac{1}{2}$ E.; this will lead between the Winter and Mallard Shoals; if intending to take the channel between the Winter and Asia Shoals, the leading mark through is Gills soap-factory chimney on with the center of West Hoe terrace, N. $\frac{1}{4}$ W.

Keep either of these marks on until Cremill obelisk is on with the second embrasure in Western King fort, W. N. W., which will lead through the fairway north of Drakes Island. When the southeast angle of Esplanade terrace, on the Hoe, comes in line with the southwest angle of West Hoe terrace, below the Hoe, E. N. E. $\frac{3}{4}$ E., haul to the southwest, and proceed with these latter marks on between Drakes Island and Vanguard Rock, until the east extremity of Cremill quay is nearly on with Wilderness Point, N. N. W. $\frac{1}{2}$ W., or Mount Wise comes well open of Devil's Point, about N. $\frac{1}{2}$ W.; then haul a-port, to bring the cupola of St. John's chapel, Devonport, in line with the flag-staff on Mount Wise, N., which will lead in mid-channel between Devil's and Wilderness Points.

The pilots, however, after rounding Vanguard Rock usually keep over toward Mount Edgecumbe battery, to avoid the strong eddy on the flood caused by Devil's Point and

the foul ground off it; bearing in mind that to clear Cremill Shoal the breakwater light-house must be kept open of Ravenness Point, S. $\frac{3}{4}$ W.

When the first building at Southdown comes open of Cremill Point, W., the vessel will be northward of the Cremill Shoal, and may run up the harbor, taking care on nearing the Rubble Bank to keep the south extremity of Drakes Island touching Cremill Point, S. E. by S., or the flag-staff at the northwest angle of the victualing-yard on with the western or brewery chimney of the same yard, S. E. by E. $\frac{1}{4}$ E.; either of these marks will lead south of the Rubble Bank, and when the tower of the dock-yard chapel opens north of the master-attendant's office, N. E. by E. $\frac{1}{4}$ E., either anchor or proceed farther up the harbor.

When leaving Hamoaze on the flood, take care to guard against the tide which sets strong from Vanguard Rock toward Barn Pool, for in the attempt to round that rock vessels are often caught by the flood on the port bow, and although they meet it with starboard helm, are frequently set into Barn Pool, even into the eddy. The ebb, from off the dock-yard, sets directly from the Rubble Bank toward Millbrook Lake, so that vessels in going out of Hamoaze on the ebb must be careful that they are not set over on the flag-ship before they can recover their course.

The Tamar River is tidal for a distance of 16 miles, to the weir-head; about $\frac{1}{4}$ mile below the latter is the entrance of the canal, which may be reached at high-water springs by vessels of 5-feet draught. On the right bank, 4 miles below the weir, is the village of Calstock, where the river is navigable for vessels of 12-feet draught at high water, and for boats only at low-water springs. Near its mouth, on the left bank, it receives the waters of the Tavy from Dartmoor forest, and on the right bank the Lyhner or St. German River, from the downs between Launceston and Bodmin. At the junction of the Tavy there is 10 feet at low water. The falls of the Tavy, about 5 miles from its mouth, may be reached at high-water springs by vessels drawing 5 feet, and vessels of 8 and 10 feet draught unload at Maristow quay, a half-mile lower down. Vessels drawing 6 feet may ascend the St. German as far as Tideford, $6\frac{3}{4}$ miles from its junction with the Tamar, at high-water springs.

Tamar River.

It is high water, full and change, at Saltash, at 5h. 45m.;

Tides.

springs rise 15 feet, neaps 11 feet; at Calstock at 6h. 6m., springs rise $12\frac{1}{2}$, neaps $8\frac{1}{2}$ feet; at Maristow at 5h. 47m., springs rise $8\frac{1}{2}$, neaps $4\frac{1}{2}$ feet.

Wembury Bay. Between the Mewstone and Yealm Head is a bight named Wembury Bay, which receives the waters of the Yealm River in its northeast corner. The outer or south point of Yealm Head is low at its extremity, and may be known by having the measured-mile beacon, painted white, on its western face. The bay has irregular depths of 4 to 8 fathoms, rock, sand, and gravel, with rocky patches of $2\frac{3}{4}$ fathoms near the shore. Two detached reefs, named the Slimers, a cable-length apart, and partly dry at low water, lie on the western shore of the bay, $1\frac{3}{4}$ cable-lengths off the east side of the Mewstone; and on the eastern shore are two patches, called the Ebb Rocks, on the westernmost of which, W. N. W. $\frac{3}{4}$ W. 3 cable-lengths from the south point of Yealm Head, is a rock nearly awash at the lowest tides, on which several vessels have been lost. The bay is $\frac{3}{4}$ mile deep, and the same in width at the entrance between the Slimers and Ebb Rocks, but it can only be considered a roadstead for vessels bound into the Yealm. Near the entrance of the latter are two tidal ledges that materially reduce the space of navigable water in the bay; Church Ledge, which projects 2 cable-lengths from the shore in a S. W. $\frac{1}{2}$ S. direction from Wembury church; and Mouthstone Ledge, 1 cable-length N. W. by W. from the inner point of Yealm Head.

The breakwater light-house on with Maker church, N. N. W. $\frac{3}{4}$ W., leads 2 cable-lengths southwest of the Ebb Rocks; and Wembury church (square tower) its own length inside the west entrance of Langdon trees, N. N. E. $\frac{1}{4}$ E., leads about $\frac{1}{4}$ cable-length from their western side. The western hedge of a narrow field on with the eastern edge of a woody patch in a valley behind, N. E. $\frac{1}{2}$ N., leads eastward of the Slimers; and New Barton farm (a solitary house near the north entrance point of the Yealm) in line with the south-east angle of a hedge inland, E. $\frac{1}{2}$ N., or Rame church open south of the Little Mewstone, leads to the southward.

Yealm River. The entrance to the Yealm is in the northeast part of Wembury Bay, $2\frac{1}{2}$ miles E. by S. from the peak of the Mewstone. It is easy to make out from being at the commencement of a long easterly range of cliffy shore, and from the

dark zigzag line marking its course through the coast-ranges 300 feet in height. The entrance between Season Point on the north and the inner point of Yealm Head on the south is $1\frac{1}{2}$ cable-length wide, and beyond this vessels drawing 12 feet and waiting tide should not proceed. Season Point is a steep cliffy head, with a black rock at its southwest face. The average depth at low water to Stert Point, 2 miles from the entrance, is 9 to 10 feet. At Stert Point, which is woody and low, the river ceases to be navigable at low water even for boats, and divides into two arms, the Cofflet and Yealmpton, which have a depth of about 10 feet at high water. Limestone and coal barges of 4 and 5 feet draught discharge their cargoes at Kitley quay on the Yealmpton. Opposite Warren Point is the Newton Ferrers Arm, which has 10 feet at high water, and vessels of 100 tons discharge at the village of Newton Ferrers on its northern shore. When there is much wind the overlooking heights along the Yealm and Newton Ferrers Arm cause sudden gusts, which make boat-sailing dangerous and the handling of sailing-vessels uncertain.

In the mouth of the Yealm it is high water, full and change, at 5h. 37m.; springs rise $16\frac{1}{2}$, and neaps $11\frac{1}{2}$ feet. During the freshets which occur between October and February the stream abreast Warren Point occasionally runs down at the rate of 4 knots; at other times its greatest velocity is $1\frac{1}{2}$ knots for the flood and $2\frac{1}{2}$ knots for the ebb. Tides.

The dangers to guard against in approaching the entrance to the Yealm are the Slimers reefs, on the western shore of Wembury Bay; the Church Ledge extending from the northern shore, under Wembury church; the Ebb Rocks off the outer point; and the Mouthstone Ledge off the inner point of Yealm Head, on the eastern shore. Vessels should not attempt to enter during strong southwest winds, when frequently a line of breakers extends across from the Slimers to the Ebb Rocks, and there are others on the irregular ground inside them. Directions.

Wembury church bearing N. E. will lead into the bay clear of all danger, until a small hummock on the high extremity of Warren Point bears E. by S. over the extremity of Misery Point. This latter mark will lead into the entrance of the river, passing $\frac{1}{2}$ cable-length northward of the Mouthstone Ledge; the latter may also be cleared by keep-

ing a clump of large trees in the valley over Cellar Bay in sight, or open of Yealm Head.

Between Season and Misery Points, and projecting from the northern shore, is an extensive sand-bank of 2 and 3 feet water, between which and the southern and eastern shore of Cellar Bay is the channel of the river, only 40 yards wide and 6 to 8 feet deep at low water after passing the bay, the deep-water line to which lies along the southern shore. The coast-guard look-out hut on Warren Point, kept open of Misery Point, leads through this channel, which ends at the latter point, off which a shoal of 3 to 4 feet water extends 70 yards.

At Misery Point the channel deepens to 12 feet, and is on the north shore; thence to the best anchorage the deepest water is 10 and 12 feet. The part of the river most frequented for this purpose is the center of the stream, between the ferry-house and the outer point of the Newton Ferrers Arm, the depth at low water being from 9 to 12 feet. The flat off Warren Point, which fronts the anchorage, should be guarded against.

Stoke
Rock. Point

About $1\frac{1}{4}$ miles southeast of Yealm Head is Stoke Point, which is a low peak with a light-colored base; $\frac{1}{3}$ mile eastward from it are two conical stone beacons 6 feet high, pointing out the position of Stoke Point Rock, which lies S. by E. a half mile from the extremity of the point, and $3\frac{1}{2}$ cable-lengths from the nearest shore. There is 8 feet water on the rock, 11 fathoms close to its south side, and 4 to 8 fathoms between it and the land. The beacons in one, N. E. by N., lead over the rock; by keeping them open it may be passed on either side; the town of Cawsand, open south of the Mewstone, N. W. by N., leads outside it.

Bigbury Bay.

Bigbury Bay is an extensive bight between Stoke Point and Bolt Tail, into which the Erme and Avon Rivers flow. It is exposed to the full force of southwest gales, and its coast is rugged and fronted at low water by rocky ledges and scattered rocks, but all these dangers are within $\frac{1}{2}$ mile from the shore, which may be approached in fine weather by vessels keeping near the land for smooth water, or to avoid the tide in the offing. This may also be done at night or in thick weather by paying strict attention to the lead. In the western part of the bay there is 19 fathoms about $\frac{3}{4}$ mile off shore; the eastern part is shoaler, 13 to 14 fathoms being found 2 miles from shore, and depths of less than 6

or 7 fathoms at low water should be avoided when the land is not visible. The Mewstone, with its light stripe, the high yellow patch on Yealm Head, the high gray cliffs between the Erme and the Avon, and Borough Island, are among the most conspicuous objects from the offing on this part of the coast. On a nearer approach, the square church-towers of Thurlestone and Churchstowe, as well as the sharp spires of those of Bigbury and Marlborough, will serve to identify the land in their immediate vicinity.

The mouth of the Erme may be readily recognized by the remarkable wooded clumps over the white coast-guard buildings just within the island-shaped point on the western side of the entrance, and by the solitary pilot's house inside Muckstone Point on the eastern side. The bar dries at low water, and vessels of 9 or 10 feet draught can ascend the river for a distance of 6 cable-lengths only when the water is smooth. Coal-barges thread their way up $2\frac{1}{2}$ miles from the entrance. This river cannot be entered when there is any swell to make broken water on the bar. The Merry Reefs lie 4 cable-lengths outside the bar, and dry at low water nearly across the entrance from the eastern shore; and Edwards Rock, with 5 feet water on it, is 2 cable-lengths outside them, and $\frac{3}{4}$ mile from Muckstone Point, with the white stone beacon close to northward of the pilot's house, in line with the west extremity of the point E. N. E. $\frac{1}{2}$ E. The pilot's house kept its own breadth open of the head, and in line with Kingston four firs (a small, solitary group on a high back ridge) is a safe lead toward the bar, passing westward of Edwards Rock, and between the Merry Reefs and Roadstead Point.

River Erme.

At the mouth of the Erme it is high water, full and change, at 5h. 40m.; springs rise $16\frac{1}{4}$ feet, neaps $11\frac{1}{2}$ feet; but inside the bar the rise is 5 or 6 feet less. Tides.

Between the Erme and the Avon, a distance of 3 miles, the coast is composed of whitish cliffs, from 200 to 300 feet high, having their base fronted with projecting ledges and numerous scattered rocks. River Erme to River Avon.

Wells Rock, with only five feet water, the most outlying danger on this part of the coast, lies $\frac{1}{2}$ mile from the shore, and from it Ringmore Church appears over the west corner of a small sandy beach, E. $\frac{1}{4}$ S., and the summit of Borough Island bears S. E. $1\frac{1}{2}$ miles.

Near the Avon the cliffs become lower, and are separated by small bays with sand and shingle beaches. In Challabro Cove, the first of these westward of the Avon, there is a coast-guard station, and limestone vessels discharge there in very fine weather.

Borough Island is a high rounded lump, resembling Looe Island, and at low water is connected with the land on the west side of the entrance to the Avon, by a sandy neck. A rocky ledge which dries at low water, extends 2 cable-lengths in an easterly direction from its eastern point, and nearly a cable-length beyond it, or 3 cable-lengths from the point, is a dangerous sunken rock, known as the Blind Mare.

River Avon.

The Avon is celebrated for its beauty, but is of limited commercial importance. Across the entrance, which is only navigable for vessels of 9 or 10 feet draught, is a bar which dries, so that it cannot be entered when there is any swell. From the high, dark, cliffy eastern head, a sandy tongue of land and spit extends well over toward a bend in the shore close within the western head, making a sudden and awkward turn in the channel, and causing a great rush of the tide by contracting the width of the stream. Coal-barges and cargo-boats discharge at Aveton Giffard, but limestone and coal vessels seldom go above the village of Bantham, 1 mile within the entrance, and often lose weeks waiting for a favorable wind and bar to get out.

Tides.

It is high water, full and change, at the mouth of the Avon at 5h. 47m.; springs rise $16\frac{1}{2}$ feet, neaps $11\frac{1}{2}$ feet, but as the bar dries before low water the rise is 5 or 6 feet less inside.

Horsewell Bay.

Between the Avon and Bolt Tail, $2\frac{1}{4}$ miles to the southward, the coast recedes forming a bight, the cliffs of which lower to the eastward and become broken into heads, which are fronted with extensive rocky ledges. In the depth of this bight, and $1\frac{1}{4}$ miles from the Avon, is Horsewell Bay, which has a long sandy beach, and is remarkable for its low shore, as well as for having near its south corner a curious perforated rock, called the Thurlestone, which from the offing resembles the hull of a stranded ship. The Thurlestone is connected with the shore at low water by a rocky ledge, and between it and Ilbert Head, the north point of the bay, is a reef called the Books, which dries at low water, and on

which many fishing-boats have been lost. Between this reef and the ledge extending from Ilbert Head is the only clear entrance into the bay, not more than $1\frac{1}{2}$ cable-lengths wide, with $2\frac{1}{2}$ fathoms in it at low water. There is three fathoms in the middle of the bay, and limestone-vessels discharge in its south corner when the water is smooth. Near the center of the bay, on the northern side of the reef which surrounds the Thurlestone, there is good boat landing at low water.

The coast from Horsewell Bay to Bolt Tail is high, precipitous, and rocky, particularly in and near Hope Cove, which is $\frac{1}{4}$ mile within Bolt Tail, and affords safe anchorage only with off-shore winds. The holding-ground is not good, but it is frequently used as a stopping place. The coast-guard flag-staff on a dark, rocky head, and a near hill-side chapel, are objects by which this cove may be easily known.

Horsewell Bay
to Bolt Head.

Between Bolt Tail and Bolt Head a succession of dark rugged cliffs rises abruptly to the height of 400 feet.

The Hamstone is a rugged, black rock, 10 feet above high water, lying $\frac{1}{4}$ mile off shore nearly midway between Bolt Tail and Bolt Head, and a little eastward of the beach of Mill Bay Cove, the only beach near. There are a few sunken rocks near it.

Hamstone.

The Inner Gregory and Outer Gregory are sunken rocks $\frac{1}{2}$ mile eastward of the Hamstone, and the same distance off shore, with 9 feet over the shoalest head. The first hummock (ruin of a signal-house) on Prawl Point, open south of the Little Mewstone (off Bolt Head,) S. E. by E. $\frac{3}{4}$ E., leads southward of them. Vessels sailing along this part of the coast, between Bolt Head and the Hamstone, should keep outside this mark, as there are several rocky heads within it.

Gregory Rocks.

Bolt Head, 416 feet high, is S. E. $\frac{3}{4}$ S., $3\frac{3}{4}$ miles from Bolt Tail. Except in the neighborhood of the Hamstone and Gregory Rocks the ground is clear between them, and the shore may be approached to the distance of $\frac{1}{4}$ mile, but there is no anchoring ground.

Bolt Head.

Eastward of Bolt Head the land is of the same height, but it rises less abruptly from the shore than it does to the westward, with few trees and intersected by deep ravines. Salcombe River is a small, well-sheltered bar harbor, the en-

Salcombe River.

trance to which may be recognized by the sudden turn to the northward of the cliffs at Bolt Head, at the base of which are two conical high-water rocks, the Great Mewstone and Little Mewstone. Vessels of 20-feet draught can cross the bar when the sea is smooth at high-water springs, and those drawing 16 feet at neaps.

Anchorage. The Range is the name given to the anchorage at the entrance of Salcombe River, but it is open to the southward. The best position is with Woodville house on with Lambury Point, N. N. E., in 6 or 7 fathoms, sand and shells. Should it come on to blow from the southward, weigh immediately, as a heavy sea is then thrown in, which makes it difficult to work out, and dangerous to cross the bar.

Rickham Rock. Rickham Rock is of small extent, with only 11 feet water; it lies $\frac{1}{4}$ mile off the eastern shore of the Range. Sandhill cottage open of Lambury Point, and on with the bend of the road on the west side of Salcombe Hill, N. $\frac{1}{2}$ W., clears the rock on its western side.

The Bar. The Bar across the entrance of the river is a ridge of sand extending from $\frac{1}{4}$ mile above the Great Eelstone, a high overhanging rock on the western shore, to Lambury Point on the eastern side; it is said to have not more than 2 or 3 feet on it at low-water springs. A heavy sea breaks over it in southerly gales.

Wolf Rock. Wolf Rock is of small extent, lying on the eastern side of the channel within the bar. It dries at low-water springs, and from it the summer-house on Pilworthy Point is on with Portlemouth ferry-house, N. E. by E. $\frac{3}{4}$ E.; and the cottage on the south side of Southsand Bay is just showing open of the south point of the bay, W. by N. Old Harry Beacon open eastward of Charles fort (ruin) leads westward of the rock.

The Poundstone. The Poundstone is a large mass of rocks on the west side of the channel, and the center of their highest part, which covers at 12 feet rise, is marked by a white beacon with a ball. From the beacon, Woodville house is on with the east side of Charles fort, from which it is distant 180 yards.

Old Harry. Old Harry, the southern extremity of the rocks, which extend off Sandhill Point, covers at 6 feet rise, and is marked by a white beacon with a ball. Charles fort stands on the inner part of these rocks.

The Blackstone. The Blackstone is a large rock on the east side of the

channel that just covers at high-water springs; its western end is marked by a red beacon with a ball. The channel between Old Harry and the Blackstone is 120 yards across.

The magnetic variation was $21^{\circ} 53'$ W. at Salcombe in 1870, decreasing at the rate of $7'$ annually. Magnetic variation.

It is high water, full and change, at Salcombe at 5h. 41 m.; springs rise 15 feet, neaps $11\frac{1}{2}$ feet. The stream turns at high and low water by the shore, and sets fairly in and out of the harbor; its greatest velocity at springs is $2\frac{1}{2}$ knots. Tides.

Pilots are generally in attendance at the entrance of Salcombe, and should be employed by strangers. To cross the bar in the deepest water, keep well over on the western shore, and steer in with Molt Point on with a clump of trees in North Sand Bay, and also on with the bend of the turn-pike road on the west side of Salcombe hill, N. by E. $\frac{1}{4}$ E. As soon as the bar is crossed, bring a small, thatched summer-house, in trees on Sandhill Point, on with the west side of Charles fort, N. E. by N.; this will lead nearly up to the Poundstone, and the vessel will then be near the beacons. Leave the red beacon on the starboard, and the white beacons on the port hand going in, and, keeping in mid-channel, proceed up to the anchorage off the town. Directions.

Should the beacons have been washed away, keep the last mark on until the whole of Southsand Bay is open, then bring the thatched summer-house on with the east side of Charles fort, and keep it so until Portlemouth ferry-house is on with the west tangent of Scoble copse, E. N. E. $\frac{1}{4}$ E.; this will lead in the best channel nearly up to Woodville house, after which keep in mid-channel to the anchorage. There is a channel with not less than 4 feet at low-water springs to the eastward of the Wolf and Blackstone Rocks, but it is narrow and winding, and should not be attempted by strangers.

CHAPTER IV.

START POINT TO BILL OF PORTLAND.

Start Point may be recognized by its rugged, cockscomb-like appearance, and by the light-house near its eastern extremity. The five hillocks on the ridge within the light-house are each about 200 feet above high water. Peartree Start Point.

Head, $\frac{3}{4}$ mile westward from the point, is 386 feet above that level. The only dangers in the vicinity of Start Point, to the south and southwest, are the Peartree, Start, and Cherrick Rocks; the two former are close to the shore, the latter lies S. $\frac{3}{4}$ W., upward of 2 cable-lengths from the point, and is awash at low-water springs. A sunken rock, with only 12 feet on it, lies at the same distance S. E. $\frac{1}{2}$ S. from the light-house, and to avoid it a vessel should not shut in the village of Haulsands with Start Point until Peartree Rocks open out south of the Start Rocks, when, giving the latter a berth of about 2 cable-lengths, she may proceed to the westward.

The soundings off Start Point are somewhat irregular, there being from 2 to 3 fathoms more water near the land than in the offing, and farther southward the depth increases again in about the same proportion.

Start Bank.

Start Bank, lying 7 miles southward of Start Point, is about a mile long, north and south, and though the least known depth is 29 fathoms the sea over it is much agitated during spring tides.

Light-house.

A circular white granite tower, 92 feet high, and 140 yards from the extremity of Start Point, exhibits, at an elevation of 204 feet above high water, a revolving light of the first order, which attains its greatest brilliancy every minute, and should be visible in clear weather from a distance of 20 miles; within the distance of 10 miles a faint continuous light is seen from the lantern. The light is screened toward the land, and is visible from seaward when bearing between S. W. $\frac{1}{2}$ W. and E.

A fixed white light is shown from the same tower, 12 feet below the revolving light, to guide vessels to Dartmouth and Berry Head. It is seen only when Start Point bears from W. $\frac{1}{4}$ S. to S. W. by S. By keeping on its western limit, it will lead between the Skerries and the land; the other limit passes over the south end of the Skerries. During foggy weather a bell is sounded.

Tides.

It is high water, full and change, at Start Point at 5 h. 41 m.; springs rise 15 feet, neaps $11\frac{1}{2}$ feet. The velocity of the stream off the point is 3 knots, but when blowing fresh there is a strong race, both on the flood and ebb, extending $\frac{3}{4}$ mile off shore.

Start Point to
Portland.

From Start Point to Portland the course is E. $\frac{1}{4}$ S., and

the distance 48 miles; and from Start Point to St. Catherine Point about E. $\frac{3}{4}$ S., 93 miles. By altering the courses successively between the meridians of the different headlands, as the vessel advances up channel, she will better counteract the effects of the tidal streams. In thick weather do not approach the shore between Start Point and Portland within the depth of 30 fathoms; this precaution will keep the vessel southward of the Shambles and Portland Race, as well as in the fair stream of tide. The soundings, however, to the southwestward, southward, and southeastward of the Casquets, within the supposed radius of 9 miles, do not materially differ from those in similar directions from Portland, so that it is possible, in bad weather, for the former to be mistaken for the latter, particularly if hazy weather prevent the three *revolving* lights of the Casquets from being distinguished, unless, indeed, soundings were accidentally struck on a bank which lies S. S. W. from the Casquets. It should be borne in mind that the northwestern of these lights bears N. W. $\frac{3}{4}$ W. from the southeastern light, the northeastern E. $\frac{3}{4}$ N. from the northwestern, and the southeastern S. W. $\frac{1}{2}$ W. from the northeastern; and thus the three lights will appear as two only when bearing in one of these or the opposite directions.

As the distance between the Lizard and Portland differs only 5 or 6 miles from that between the Lizard and Casquets, and as this is the narrowest part of the channel westward of Beachy Head, it is necessary to exercise great caution; for should a stranger be in this supposed southerly position during a winter night, between the periods of low water and three-quarters flood on the shore, when the in-draught is strong into the Gulf of St.-Malo, and with a gale between S. W. and N. W., the consequences might be most disastrous. By constant attention to the lead, from the instant of first striking soundings, such a perilous situation would be avoided. The Casquets bear from Start Point S. E. $\frac{3}{4}$ S., 57 miles, and from the Bill of Portland S. by W. $\frac{3}{4}$ W., 47 miles.

Nearly a mile E. $\frac{1}{4}$ S. from the Start light-house is the southernmost extremity of the Skerries, a dangerous bank of pulverized shells and fine gravel, which extends N. E. by E. $\frac{3}{4}$ E., $3\frac{1}{2}$ miles, with an average breadth of half a mile. Near its south end there is only 9 feet water, on the other

Skerries Bank.

parts from 2 to 4 fathoms, with occasional deeper casts. The shoal terminates to the northeast in a sand-bank nearly a mile in length, with 3 fathoms on its shoalest part. In boisterous weather the sea breaks heavily on all parts of the Skerries, but particularly upon the southwest end; there is no shelter between it and the land in strong easterly winds, as the broken water reaches to the shore. At the north end of the Skerries the tide runs at the rate of $2\frac{1}{2}$ knots.

Directions.

Berry Head open of Downend Point, N. E., leads eastward of the Skerries; Street church on with the highest part of Street-head cliff, and a little open of the north end of Slapton beach, N. N. W. $\frac{1}{4}$ W., leads northward; the Mewstone peak just open of the high land of Downend Point, N. E. by E. $\frac{1}{2}$ E., leads between the Skerries Bank and the land; the west end of the trees over Widdecomb house in line with the northern white house in Beesands, N. by W. $\frac{1}{4}$ W., leads between Start Point and the southwest end of the bank; and Prawl Point open of Start Point, W. $\frac{1}{2}$ N., clears its south end. To avoid this bank at night, do not stand toward it into less than 20 fathoms at low water. To pass between it and the land, keep the fixed light on Start Point S. W. $\frac{1}{2}$ S., and pass the point at the distance of $\frac{1}{4}$ mile on its northern side, and $\frac{1}{2}$ mile on the southern. When the Start light bears N. W. by W. $\frac{1}{2}$ W., the vessel will be southward of the Skerries.

Start Bay.

Start Bay is within the Skerries, and its shore is bordered by a beach 5 miles in length, extending from Haulsands to Street Head. The whole of it, within the clearing marks for the Skerries, affords good anchorage in 7 to 8 fathoms, over sand and gravel, except in strong easterly winds and within $\frac{1}{2}$ mile from Start Point, where the ground is rocky, and the tide might set a weak-handed vessel on shore in getting under weigh, before she is fairly under canvas, if too close in. In Start Bay the tides are weak and irregular, their general direction, nine hours out of the twelve, being to the southward, close to the shore.

Start Point shelters the bay with the wind to the westward of S. W., but if it should veer to the southward of S. S. W., weigh and run for Dartmouth or Torbay, as a heavy sea is thrown in by southeasterly gales. In the northern part of the bay, upward of $\frac{1}{2}$ mile W. S. W., $\frac{1}{2}$ W. from Combe Point, is a sunken rock with $3\frac{1}{2}$ fathoms over it,

called the Earlstone. The outer Combe Rock, 11 feet above high water, on with the Blackstone at the entrance of Dartmouth, N. E. by E., leads eastward of the Earlstone; and the boat-house in the center of Blackpool Bay well open of Stoke Point W. N. W., leads southward of it. From Start Point toward Dartmouth the coast is generally low, rising gradually in the interior.

Dartmouth stands on the right bank of the river Dart, near its mouth, and has a spacious harbor, capable of containing a large fleet of ships of the greatest draught. The entrance is only 220 yards wide from rock to rock, and both to the eastward and westward the shore is steep and rocky, dangerous to approach in boisterous weather, and fatal to be cast upon, without one yard of sand or shingle on either side for miles, on which a vessel could be safely beached. This port affords great facilities for obtaining supplies of all descriptions, including excellent water. There are good building-yards, with two patent slips, 450 and 250 feet long, a powerful steam-tug, and a coal hulk for supplying steamers. Vessels drawing 14 feet can discharge afloat alongside the railway wharf. The Dart is navigable by vessels of 150 tons as far as Totness, a distance of 10 miles.

Dartmouth.

On the northern or Kingswear side of Dartmouth Harbor is an octagonal tower from which is exhibited, at an elevation of 85 feet above high water, a fixed light which shows bright through an angle of $9\frac{1}{2}^{\circ}$ over the fairway of the entrance, or when bearing from N. by W. $\frac{1}{4}$ W. to N. $\frac{3}{4}$ W.; red between the former limit and the land to the northeast, over the shoals of Castle Ledge and Kettle Point; and green between the bright arc and the land to the southwest, over the Pin Rock and Checkstone Shoals. In clear weather the light should be visible from a distance of 11 miles.

Lights.

On a flag-staff 110 feet seaward from the light-house a fixed bright leading light is shown at an elevation of 70 feet; the lights in line, N. $\frac{3}{4}$ W., lead through the middle of the channel.

After passing between Castle and Kettle Points, a fixed bright light near the coast-guard station, at the southern end of the town of Dartmouth, will indicate the fairway to the anchorage; this light shows red over the shoals on the north side of the harbor, and green over the shoals off One Gun Point on the south side.

Beacon.

A beacon or day-mark in the form of a truncated pyramid, 80 feet high, stands on the high land, about 500 feet above the sea, half a mile N. E. by N. from the outer Froward Point, at the eastern side of the entrance to the harbor.

Anchorage.

Outside the entrance of Dartmouth Harbor, within Blackstone and Froward Points, is a small roadstead called the Range, which may be used as an occasional anchorage. The holding-ground is excellent, with water of moderate depth, and little tide; but as it is open to winds from S. S. E. to S. S. W., it should not be resorted to as a place of refuge. With strong southerly winds on an ebb tide the sea breaks heavily across the roadstead; and indeed there is generally a heavy swell with anything like bad weather in the offing. If caught there with the wind blowing hard from the southward, a vessel has no alternative but to slip and run into the harbor.

There is good anchorage in the harbor anywhere above One Gun Point, the usual place being near the town off the New Ground, in 22 feet water, which is to be preferred, if a vessel is to remain any time, as most convenient for obtaining supplies, and being entirely out of the way of vessels entering; but if the harbor is resorted to for temporary shelter, the anchorage in 7 to 10 fathoms between Old Dartmouth Castle and Warfleet Cove is better, for it will be comparatively easy for a vessel to get to sea from the latter on a flood tide, when it would be hardly possible to do so from the upper anchorage.

Dangers on W.
side of entrance:
Combe Rocks.

Immediately off Combe Point lies a group of rocks, many of which are at all times above water, and all of them show at low tide; the outer rock of the group, the Outer Combe, lies rather more than a cable-length from the shore, and dries at half tide. It is scarcely $\frac{1}{2}$ cable-length eastward of the Old Combe Rock, which is always above water, and may be closely approached when visible.

Mag Rocks.

About $\frac{1}{4}$ mile N. E. by N. from the Outer Combe Rock a succession of high heads show themselves from half ebb to low water; these are called the Mag or Mica, inside of which no vessel should venture. Kingswear Castle open of Blackstone Point, N. E. $\frac{1}{4}$ N., leads eastward of these heads, as well as the Outer Combe, and all dangers between Combe and Blackstone Points.

A patch of rocks, dangerous even to small vessels, lies $\frac{1}{4}$ mile E. S. E. from Combe Point, with a safe, deep channel between it and the Combe Rocks. The highest head of the patch is called the Homestone, over which there is not more than $4\frac{1}{2}$ feet at low water. From it Kingswear Castle is on with the highest point of the Blackstone Rock, N. E. by N.; and a high and remarkable needle-rock at Combe Point is in line with Stoke Fleming church. Kingswear Castle open east or west of Blackstone Rock clears it on either side; and Stoke Fleming church in line with the extremity of Combe Point leads to the southward. A buoy, painted with black and white rings, is moored about $\frac{1}{2}$ cable-length southeastward of the rocks.

About 127 yards N. E. of the Homestone buoy is a patch with only 17 feet at low water, which should be carefully avoided by vessels of great draught. St. Petrox church just open of Blackstone Point, N. by E., leads $\frac{1}{2}$ cable-length to the eastward.

Pin Rock, about $\frac{1}{2}$ cable-length in extent, lies $\frac{1}{3}$ mile eastward of Homestone Rocks, with Blackstone Rock and Point in line. The least water on it is $4\frac{1}{2}$ fathoms, and it is only dangerous to vessels of great draught, or when a heavy sea is running. There is 7 to 10 fathoms close around it.

In line between Pin and Blackstone Rocks, and $\frac{1}{4}$ mile from the latter, is a small rocky patch with 25 feet water.

Blackstone Rock, 8 feet above high water, lies a cable-length S. by E. $\frac{1}{2}$ E. from Blackstone Point, and care should be taken when passing it to avoid a sunken rock 70 or 80 feet off its eastern extremity. Small vessels sometimes run between Blackstone Rock and the Point, which is attended with some risk, for a shoal head with only 5 feet water lies nearly in mid-channel; but as nothing dries at low water except the rocks off Blackstone Point, and the tide rises 16 feet, a vessel may, in case of necessity, use this channel at or near high water, taking care to keep closer to the rock than to the point.

A group of rocks, some never covered, and most of them dry at low-water springs, extends a considerable distance from the shore a little to the southward of Battery Point, and as the narrowest part of the channel is approached, the outer rock, called the Checkstone, with only a foot of water on it, greatly encroaches upon the fairway. A black and

white checkered buoy marks its position, but as there is as little as 13 feet to the eastward of it, the buoy should not be too closely approached. Kingswear Point touching Battery Point, N. by W. $\frac{3}{4}$ W., leads eastward of the 13-foot patch.

There is also a small detached rock near Dartmouth Castle, but too close in to be of much importance.

Dangers E. side
of Entrance:
Mewstone.

The Mewstone, a rocky islet 125 feet above high water, lies about $1\frac{1}{2}$ cable-lengths off shore, a little to the eastward of Outer Froward Point, and is steep to on its eastern side, but the channel between it and the land should not be attempted. If from any cause a vessel is carried through by the tide she must be kept as nearly as possible in mid-channel, as the rocks dry off for a considerable distance on both sides.

The Verticals.

Beyond the many high rocks extending in a westerly direction from the Mewstone is a ledge of dangerous rocks, running parallel with the coast fully $\frac{1}{4}$ mile west of the Mewstone. Some of these rocks, which, from their high and precipitous sides are called the Verticals, show at low water. The west rock of the Verticals dries only at the lowest tides, and as there is a shoal spot with only 24 feet, upward of a cable-length westward of it, it will be prudent, from the suspicious nature of the bottom, and the set of the flood tide, to give this locality a wide berth; Kingswear Castle well open of the extremity of Inner Froward Point, N. N. W., leads westward of the 24-foot rise.

As the water suddenly deepens to 10 fathoms southward of the Verticals, the lead is of little use, but in daylight a good clearing mark is the East Blackstone well open of the Mewstone, E. $\frac{1}{4}$ N., which will also lead southward of all the dangers off Dartmouth. The East Blackstone, the Mewstone, the high rock near it south of the Shooter, the Verticals, the Pin, the Homestone, and the rocks off Combe Point lie nearly in line; as do also the Mewstone, the Shooter, the Bear's Tail, Castle Ledge, and the Blackstone.

Bear's Tail
Rock.

Bear's Tail Rock lies rather more than $\frac{1}{2}$ cable-length south of Outer Froward Point, and dries at low water; but as it is out of the proper track of vessels it needs no further notice than to point out as a warning to small craft or boats intending to run between the Mewstone and the shore that

Kettle and Inner Froward Points in one lead over it, as do also the highest peaks of the Shooter and Mewstone.

A patch of sunken rocks lies upward of $\frac{1}{4}$ mile westward of Outer Froward Point, and a little less than that distance from Inner Froward Point with a good channel for small vessels inside it. On this patch are several shoal heads, two of which require to be particularly noticed. The inner head, called Old Castle Rock, has only 4 feet water, and from it the ruin of the old castle at Dartmouth, which stands at the southern end of the town, is seen touching Battery Point.

Castle Ledge, the outer head of the rocks off Inner Froward Point, has only 8 feet water, and lies with the light-house under Beacon Hill, just touching Kettle Point; and the peak of the Mewstone over the south tangent to the Shooter. A black buoy is moved in $4\frac{1}{2}$ fathoms, $\frac{1}{2}$ cable-length outside Castle Ledge.

Mewstone Peak open of the Shooter leads to the southward, and the castle flag-staff in line with Mount Boon house, or Battery and Kingswear Points, touching N. by W. $\frac{3}{4}$ W., lead to the westward. The latter is the fairway mark up to Battery Point, and leads eastward of the Checkstone. Beacon Hill in line with Kingswear Castle and outside Inner Froward Point, N. N. W., clears the tail of the Verticals and the Bear's Tail, and leads inside Old Castle Rock.

From Castle Ledge to Kettle Point the shore is clear and bold, but 60 feet outside the point is a small sunken rock with only 3 feet water on it. Kettle Rock, which dries at low water, lies inside the point, close to the shore.

The magnetic variation at Dartmouth was $21^{\circ} 33'$ W. in 1870, diminishing at the rate of $7'$ annually.

It is high water, full and change, at Dartmouth harbor at 6h. 16m.; ordinary springs rise 14 feet, neaps 10 feet. At Ditcham it is high water 6 minutes later than at Dartmouth, and the rise is the same; at Totnes 24 minutes later than at Dartmouth; springs rise $10\frac{3}{4}$ feet, neaps $6\frac{1}{2}$ feet. At Blackstone Rock and Castle Ledge buoy, or anywhere within the range, the stream turns with the tide on shore, but at the Homestone about $2\frac{1}{2}$ hours later.

From a half mile to a mile outside the Homestone the flood sets to the southward of the Mewstone, but at the Homestone its direction is about E. N. E. toward Inner

Froward Point until within a few yards of the shore, gradually becoming weaker as the land is approached. Thence it turns to the southward, running close in shore inside the Castle Ledge, acquiring strength as it rounds Outer Froward Point, which having passed it sweeps to the eastward inside the Mewstone, its rate varying from 1 to 2 knots.

At Castle Ledge buoy the first of the flood by the shore sets about S. E. by E. toward the Verticals, and meets the last of the Channel ebb as soon as those rocks are passed. The flood splits at Blackstone Point, within which it curves gradually toward the entrance, and runs sluggishly until within the points. The principal eddy on the flood is that which runs along the eastern shore round the Froward Points, but there is also a slight eddy running down close to the rocks between Brook Hill and Kettle Point. Along the western shore the tide is weak on the flood outside the harbor; but a strong eddy runs inside the points, from the coast-guard station to One Gun Point, which commences 2 hours after low water.

The ebb sets obliquely across the harbor from the ferry slip at Kingswear toward the coast-guard station, which stands in the bight about half way between the town and One Gun Point; thence it runs out between the points, and sets in a southerly direction until past Castle Ledge, where it is met by the offing ebb, with which it mingles, and is deflected to the westward, running outside the Homestone.

There is a strong eddy on the ebb in the bight from Kittery Corner to abreast One Gun Point, of which the pilots avail themselves in light southerly winds, when it would otherwise be difficult to reach the anchorage. A weak eddy will also be found between One Gun Point and St. Petrox, but it extends only a few yards off shore. Both the strength and breadth of the eddies depend much on the velocity of the stream, varying according to the state of the tide and the freshets, and requiring at all times much caution.

Conspicuous
objects at en-
trance.

The entrance to Dartmouth is 5 miles S. W. by W. of Berry Head, and its position may be recognized from seaward by the granite peaks or tors which break the outline of the Dartmoor range. The most remarkable of these are Haytor and Rippon tor, the latter 1,525 feet above high water, being distinguished by a single culminating point or cairn, while Haytor presents a forked or jagged appearance.

Rippon tor, bearing N. $\frac{1}{2}$ W., leads to the entrance of the harbor, which, as the land is approached, will be more distinctly recognized by the tall square tower of Stoke Fleming Church, standing on high ground about $1\frac{1}{2}$ miles westward of the entrance, and also by the Mewstone, a remarkable rocky islet $\frac{3}{4}$ mile to the eastward.

The picturesque old church of St. Petrox, with the castle adjoining it, stands out in bold relief on the brink of the precipitous rock at Battery Point, on the western side of the entrance. On the eastern side, near the water's edge, is Kingswear Castle, a low square tower, the sea-face of which is white. Blackstone Rock, off Blackstone Point, is also useful as a clearing-mark for the shoals near the entrance.

Many experienced pilots belong to the port, and during the summer months they cruise outside the entrance of the harbor from daylight till dark. Pilots.

When seeking refuge in Dartmouth harbor in a gale between S. W. and S. E., if in Start Bay or to the westward of Dartmouth, keep about a mile from the shore and run to the eastward till the entrance opens out, which it will do on a N. E. by E. bearing; continue on till Dartmouth Castle is in line with a large house on Mount Boon, N. by W. $\frac{3}{4}$ W., or Battery and Kingswear Points touch, which will lead in the fairway for the entrance. When about $1\frac{1}{2}$ cable-lengths from Battery Point, steer midway between the points and anchor in 7 to 10 fathoms off Warfleet Cove, $\frac{1}{4}$ mile within the entrance. Directions.

At night keep in the sector of bright light between the bearings N. by W. $\frac{1}{4}$ W. and N. $\frac{3}{4}$ W., and when the leading light is seen, bring it on with the upper light, N. $\frac{3}{4}$ W., and continue on through the fairway of the entrance until well within the sector of bright light on the Dartmouth side, then steer for it, and select an anchorage as convenient.

If to the eastward of Dartmouth, with a southwesterly wind, run for Torbay, the only secure anchorage in bad weather between Dartmouth and Portland.

Sailing-vessels sometimes experience considerable difficulty in getting in and out of Dartmouth, partly owing to the perplexing eddies at the entrance, but more from the baffling winds which blow off the high lands, sometimes with considerable violence, especially if the wind be westward of N. W., when it requires all the skill of an experi-

enced pilot. The true winds are N. W. and S. E., and as a general rule, in moderate weather, with the wind between N. W. by N. and N. N. E., and S. W. and S. E., a vessel will be found pretty well under command.

The channel between Combe Rocks and the Homestone may be used with advantage under some circumstances, particularly with scant westerly winds. Working in or out of the harbor with baffling flaws, the truest wind will be found on the side of the Range opposite to that from which it blows. A stranger should not attempt to work into the harbor, particularly at night, without a pilot; but by attending to the marks in the day-time, with a fair wind, or in a steamer, or at night by keeping in the bright sectors of light, there can be no great risk in almost any weather.

In a sailing-vessel great care should be taken when leaving the harbor, bound to the eastward, particularly in light winds, not to be caught by the flood-tide near Outer Forward Point, as it would be likely to set the vessel either inside the Mewstone, or on the Verticals. In most cases, without a commanding breeze, she would have to trust to her anchors in foul ground. When the East Blackstone is open south of the Mewstone, safety is pretty certain; the latter may be rounded to the southward within a moderate distance.

The river above Dartmouth being winding and intricate, is only used by vessels drawing less than 10 feet, and to navigate between its banks and shallows local experience is needed. The Anchorstone, a half-tide rock, lies $1\frac{1}{2}$ miles above the town, in a direct line between Ditsham Rectory boat-house and Greenway boat-house, one-third over from the eastern bank; on its western side is 8 feet water, and on its eastern side 12 fathoms.

Dartmouth to
Berry Head.

The coast from the Mewstone trends in a northeast direction $4\frac{1}{2}$ miles to Berry Head, with high undulating land. To the northward it rises to a height of 490 feet, one mile within Sharkham Point, the pitch of which is 213 feet high. At Scabbacombe the summit of the cliff is 420 feet above high water; again at Downend Point, where the cliff is 200 feet high, the land rises, half a mile in the interior, to 510 feet. Between the Mewstone and Berry Head the shore is dangerous to approach within $\frac{1}{2}$ mile, there being in this space

the following steep and dangerous rocks, having 6 and 7 fathoms water near them :

East Blackstone Rock, 10 feet above high water, lies 1 ^{East Blackstone Rock.} mile S. W. by S. from Downend Point, but has no outlying dangers.

Bootfield Rock, with 9 feet water, lies off the southeastern extremity of Downend Point, about 2 cable-lengths from the shore. A projecting rocky point, $\frac{1}{2}$ mile to the southward of Sharkham, open of Downend Point, N. N. E. $\frac{3}{4}$ E., leads to the eastward. Bootfield Rock.

Nimble Rock, with only $3\frac{1}{2}$ feet water, and steep-to, lies about $\frac{1}{3}$ mile off shore, a little south of Downend Point. From it Start Point light-house is in line with the East Blackstone, and the northeast tangent of Downend Point is on with the highest part of Scabbacombe cliff. The light-house open east of the East Blackstone leads eastward of the rock ; and open west, leads between it and the land. Nimble Rock.

Mudstone Ledge lies S. S. W. $\frac{1}{2}$ W. 1 mile from Berry Head, and about half that distance eastward of Sharkham Point ; there is $4\frac{1}{2}$ fathoms on its outer end. Hope Nose well open of Berry Head, N. N. E. $\frac{1}{4}$ E., leads to the eastward. Mudstone Ledge.

The Cod Rocks are two steep and rocky islets 50 feet high. The outer one bears S. by W. $\frac{3}{4}$ W. $\frac{1}{3}$ mile from Berry Head, and is $\frac{1}{4}$ mile off shore ; there is no channel between them and the land. Cod Rocks.

When abreast the Mewstone keep Hope Nose open of Berry Head, N. N. E. $\frac{1}{4}$ E., and it will lead eastward of all the dangers between Dartmouth and Berry Head. Directions.

Between Dartmouth and Berry Head the stream turns in-shore an hour earlier than in the offing.

Berry Head, a limestone cliff steep-to and nearly vertical, is 180 feet high, with a flat or table summit, and may be seen in clear weather from a distance of 20 miles ; quarries are extensively worked on its northern face. Hope Nose is $3\frac{3}{4}$ miles N. N. E. $\frac{1}{4}$ E. from Berry Head, and between them is the deep indentation called Torbay, which affords good shelter from westerly winds ; but the mariner is warned against being caught in it by a southerly or southeasterly gale, as they throw in a heavy sea. The three tidal-harbors of the bay, Brixham, Paignton, and Torquay, should not be run for with on-shore gales. Torbay.

Off the northern shore of the bay, near Hope Nose, are three rocky islets, the Orestone, which has a small rock $\frac{1}{2}$ cable-length from its south point, the Thatcher, and Flat Rock; and to westward of these are the Morris Rogue, East Shag, and West Shag Rocks.

The Ridge is a small rocky patch with $3\frac{1}{4}$ fathoms on it, from which the Thatcher is on with Hope Nose, N. E. by E. $\frac{1}{2}$ E., and Smoky House mill (a ruin) is in line with the western fall of the red cliff on the southern side of Roundham Point, N. by W. $\frac{1}{4}$ W.

Brixham. The fishing-town of Brixham stands on the southern shore of the bay $1\frac{1}{4}$ miles from Berry Head, and has a pier harbor with 10 to 15 feet in it at high-water springs. A breakwater, about a quarter of a mile eastward of the entrance, extends 250 yards from the land and affords shelter to small vessels. There are [several shipwrights' yards at Brixham, and a large reservoir of fresh water for the use of vessels in the bay, with pipes to the eastern pier-head.

Paignton. On the western shore of Torbay, just north of Roundham Point, is the small pier harbor of Paignton, which has 8 to 10 feet in it at high-water springs.

Torquay. The town of Torquay stands on the northern shore of the bay, at the meeting of two deep valleys. A pier has been constructed inclosing an area of about 8 acres, which can be entered by vessels of 16 or 17 feet draught at all times of tide.

Mooring-buoys have been laid down throughout the harbor, store-houses erected, and cranes provided for handling cargo. Stores and coal for steamers may be obtained.

Lights. • A small fixed red light is exhibited from an iron stand, 20 feet above high water, at the western pier-head of Brixham Harbor. There is also a fixed red light, 15 feet above high water, on the southern pier-head at Torquay. Both lights may be seen in clear weather from a distance of 5 or 6 miles.

Life-boats. A life-boat is stationed at Brixham, and another at Torquay.

Magnetic variation. The magnetic variation was $21^{\circ} 43'$ W. in Torbay in 1870, diminishing at the rate of $7'$ annually.

Tides. It is high water, full and change, at 6h. 0m.; springs rise $13\frac{1}{2}$ feet, neaps 10 feet.

Avoiding the Ridge, the whole of Torbay affords good anchorage in 6 or 7 fathoms, mud and clay, sheltered in all winds between N. E. and S. by W., or even S. S. E. if a berth be taken up in-shore, on the southern side of the bay. It is open to the eastward, and southeasterly gales send in a heavy sea; yet Brixham Road, having an underset to windward that strengthens with the wind, affords easy riding. The best position with southwesterly winds is with Brixham church and pier-head in line, bearing about S. W., and Berry Head between S. and S. S. E. Large ships should not anchor farther southward than to have Paignton church on with Roundham Point, N. W. $\frac{3}{4}$ N.; nor farther westward than to bring the high part of the Thatcher over the narrow neck of Hope Nose, N. E. $\frac{1}{4}$ N. Here they will be sufficiently out to secure an offing in case of a south-east gale. Should a vessel be obliged to run on shore in the southwest angle of the bay, there is a beach sheltered by rocks in a little bight called Elbury Cove; by running for this many crews have been saved, and the vessels subsequently got off; while others driven on shore to the northward have become total wrecks.

Entering Torbay from the southward, Berry Head, which is steep-to, may be rounded at any convenient distance. With the exception of Shoalstone Point, off which a reef extends about a cable-length, the whole of the south shore of the bay is clean, and the soundings are regular. In running for Brixham Harbor by day, vessels must keep outside the red buoy which marks the outer end of the breakwater; and when making for the harbor from the eastward at night they should keep well to the northward of Shoalstone Point until the red light on the pier opens out; the light then kept S. W. will lead in clear of the end of the breakwater.

A vessel bound into the bay from the northward may, if necessary, pass in mid-channel between the Orestone and the Flat Rock off Hope Nose, as the passage has 5 to 9 fathoms water. The Orestone kept its own length open of the Thatcher, E. $\frac{1}{2}$ S., clears the rocks and foul ground on the northern side of the bay; and this bearing, with the whole of Torquay open of Beacon Hill, N. N. E. $\frac{1}{2}$ E., marks the anchorage in Torquay Road.

Babbacombe Bay, $1\frac{1}{2}$ miles northward of Hope Nose, affords good anchorage with westerly winds, in 4 to 5 fathoms.

Anchorage.

Directions.

Babbacombe Bay.

oms over sandy bottom ; thence to Portland the anchorages off the small towns are sheltered from northerly winds only.

Teignmouth.

Teignmouth, at the mouth of the river Teign, is N. by E. $\frac{1}{2}$ E. $4\frac{1}{2}$ miles from Hope Nose, and N. W. by W. $\frac{3}{4}$ W. 39 miles from the Bill of Portland. The river falls into the sea through a narrow channel, obstructed by a bar which nearly dries at low-water springs, and is ever changing from the effects of freshets and southerly gales. From the Ness on the south side of the entrance, to Ferry Point on the north side, the distance across at high water is only $\frac{1}{4}$ mile. The Ness is a beautiful headland of red sandstone clothed with verdure, rising boldly from the water's edge to the height of 174 feet. Ferry Point, which terminates the promenade called the Denn, is a long low tongue of loose shingle, changing with every gale of wind.

The channel into the river is nearly straight, about $\frac{1}{2}$ cable-length wide at low tide, and most water will be found on the south side. It lies between two sands which uncover considerably. Spratt sand, on the north side of the channel, is by far the most extensive, and the high head of fine shingle heaped up near its outer end, which changes with the weather, is called the East Pole. The Pole or Ness sand is on the southern shore, and dries above a quarter of a mile outside the point. There are no rocks on the north side of the channel, but many patches of large loose blocks of red sandstone extend the whole way round the Ness up to the anchorage in Shaldon Pool, the limits of which are imperfectly pointed out by two rough buoys painted red ; the western patch is called the Bench Rocks.

As the bottom is entirely free from rocks at the entrance, a vessel can anchor outside the bar according to her draught ; but the shoal water extends a long way outside the sand heads, and as little as 12 feet may be expected $\frac{1}{3}$ mile from the Ness. To insure 18 feet at low water Berry Head must be kept open of Hope Nose, which will lead upward of $\frac{1}{2}$ mile outside the sand heads, and be found a safe turning mark for a stranger between Torbay and Teignmouth.

Life-boat.

There are patent slips and a steam-tug in the port, and a life-boat is stationed on the Denn.

Lights.

The light-house inside Ferry Point on the southwest end of the Denn exhibits at an elevation of 34 feet above high

water a fixed red light, which may be seen in clear weather from a distance of 6 miles; a small shifting red light is shown from one of the houses behind it, and the two in one clear the rocks off the Ness, and the highest part of the Pole sand, and lead up to the fairway, the approach to which can only be estimated by a bearing of the land and attention to the lead.

It is high water, full and change, at Teignmouth at 6h. Tides.
0m.; springs rise 13 feet, neaps $9\frac{1}{2}$ feet. Outside the bar the time is about 25 minutes earlier, and there may be six inches more rise and fall.

On the bar the flood stream makes into the river nearly half an hour after low water by the shore, and before the banks are covered sets up the channel with a velocity of $\frac{3}{4}$ to $1\frac{1}{2}$ knots; but as the tide rises its direction is over the Spratt sand, which should be allowed for when working into the harbor with light winds. The tide has no great strength until near Ferry Point, round which it sweeps from half tide to nearly high water at the rate of 4 to 5 knots, causing strong eddies near the beach on both sides. Inside Ferry Point, at half tide, the flood flows over the east end of Salty flat, and at or near high water makes a nearly straight course from Ferry Point to the bridge, running from $\frac{1}{2}$ to $1\frac{1}{2}$ knots.

In much the same way the course of the ebb stream depends entirely on the state of the tide. From the bridge the first-quarter ebb runs over the low part of Salty flat for Shaldon Pool; but as the tide falls, or a little after half ebb, it drives through the channel with considerable velocity, much influenced by the quantity of fresh water in the river. Under ordinary circumstances its average rate is 1 to $1\frac{1}{2}$ knots from the swing-bridge to the moorings; below the moorings 3 knots; at Ferry Point 5 knots, slackening immediately after passing the Ness; and 1 to $2\frac{1}{2}$ knots over the bar. There is no eddy on the ebb on the western shore below the Bench Rocks, for the true stream runs close past them, as it does also on the opposite side near Ferry Point. On the bar the first and second quarters' ebb set about E. N. E.; and after half tide S. E., meeting the true tide a short distance outside the bar.

It would be most hazardous to trust to Teignmouth for refuge in bad weather, for the ground swell, which generally Directions.

precedes a southerly gale, soon becomes a heavy breaking sea as the wind increases. If unable to cross the bar, which would be attended with much danger and difficulty, the only alternative is to secure an offing as quickly as possible, bearing in mind that there is no shelter between Dartmouth and Portland Road.

As the sands are constantly shifting, no leading marks can be depended on with certainty; but as buoys are not laid down to mark the channel at the entrance, it may be useful to know that the south arch of the bridge, or the junction of the staging with the masonry, which is very observable, just shut in with the outer end of Ferry Point, will lead over the bar and toward Spratt sand. This course should be continued until the light-house is in line with the coast-guard flag-staff; then haul over for the Shaldon shore, steering for the south house in Shaldon, until the north west house or tangent to the house comes on with the above arch, which will lead up to Shaldon Pool in mid-channel, and abreast the fairway buoys on the starboard hand.

From this position to the moorings off Teignmouth, where vessels may ride in 10 to 12 feet at low water, the channel is marked by seven buoys on the edge of Salty flat, viz, four red, one striped black and white, one black, and one red, all of which must be left on the port hand. A large red barrel-buoy is placed at Ferry Point; but as the sand at low water dries for a short distance around it, give it a tolerable berth in rounding the point. There is room for a few small craft in Shaldon Pool, out of the way of vessels entering the harbor; the best berth is abreast the south end of the town a little above the Bench Rocks, out of the strength of the tide. A swing opening through the bridge admits vessels drawing 11 feet to the upper part of the river, but the principal part of the traffic is carried on in barges; for these, and even for small vessels, a channel has been cut and buoyed as far as Newton.

Dawlish.

Dawlish is a small watering place between Teignmouth and Exmouth. The town, with the parish church and a few villas, stands in a valley $\frac{1}{2}$ mile from the sea. Dawlish Rock, with 11 feet water, lies abreast the town nearly $\frac{1}{2}$ mile off shore, with Exmouth church just open of Warren Point, N. E. by E. $\frac{1}{4}$ E., and Mamhead tower and coast-guard flag-staff in line, N. W. $\frac{3}{4}$ W.

The mouth of the river Exe bears N. E. $\frac{1}{2}$ N. $12\frac{1}{2}$ miles from Berry Head, and N. W. by W. $\frac{1}{4}$ W. 35 miles from the Bill of Portland. Within it is the harbor of Exmouth, which is difficult of access at all times, unapproachable in a heavy sea, and should not under any circumstances be depended on for refuge in bad weather. The town of Exmouth is a mile within the entrance, and has a floating dock 530 feet long and 300 feet wide, with a dry-dock (building) 250 feet long and 58 feet wide opening from it. At Topsham, 5 miles up the river, there is a dry-dock 190 feet long, 42 feet wide, and 32 feet between the gates, with 10 feet over sill at high-water springs, and 7 feet at neaps. The canal leading to Exeter commences a mile below Topsham, and is five miles long, 30 feet wide, and 13 feet deep, terminating in a lock and basin. The lock is 120 feet long and 28 feet wide, and the basin, which is opposite the quay at Exeter, is 917 feet long, 18 feet deep, and from 90 to 110 feet wide. Vessels must lighten to 12 feet before they can enter the canal.

The approach to the entrance is between a long sandy point on the western side, called the Warren, extending $1\frac{1}{2}$ miles from Langstone Point, and Orcomb Point, rising about 60 or 70 feet above high water, on the eastern side. The Warren is covered with coarse grass and abounds with rabbits. The channel is very narrow, with a long shallow bar of broken water, bounded on its north side by a fringe of dangerous rocks uncovering only at low water, and on the other side by far-spreading, treacherous sands.

A life-boat is stationed at the entrance of the harbor.

Life-boat.

A buoy striped black and white, horizontally, with a beacon, is moored in 6 fathoms a mile outside the entrance, with Exmouth church in line with the southeastern house on Beacon Hill, N. N. W. $\frac{1}{2}$ W.; and Mamhead tower just open north of Langstone Point, W. N. W. $\frac{1}{2}$ W.; the tower stands conspicuously on the high land to the southward of the obelisk on Great Haldon hill.

Fairway buoy.

Orcomb Ledge extends nearly $\frac{1}{4}$ mile from Orcomb Point; and as no buoy marks its extent it is dangerous to vessels entering the harbor. The rocks dry at half-tide and extend to the eastward as far as Straight Point, and in the direction of the harbor channel for $\frac{3}{4}$ mile. Various names have been given to the salient prongs of this ledge, viz: Orcomb

Orcomb Ledge.

Ledge, Flat Ledge, Page Ledge, Double Ledge, Long Ledge, and Congar Rocks; and five black buoys mark their outward edges.

Day's Ledge. Day's Ledge is a small patch of rocks which dries at low water. It lies on the eastern side of the channel, at the point under Gun Cliff, near the coast-guard station, and is much in the way of small vessels; but its position is sufficiently pointed out by a black buoy placed well outside it.

Checkstone Ledge. Checkstone Ledge is a cluster of flat rocks, which dry only at spring tides, a little above Day's Ledge, on the western side of the channel, and its northern extremity is marked by a buoy with black and white vertical stripes. A perch is also erected on a small rock called the Checkstone, which is considerably within the ledge and out of the fairway.

Pole Sand. The Pole Sand extends $1\frac{1}{2}$ miles outside Warren Point, parallel to the opposite shore, and dries at low water to abreast Orcomb Point. It narrows the entrance considerably, and is marked by three white buoys with black and white vertical stripes, besides the one on the Checkstone Ledge.

The Swashway. Between Warren Point and the Pole Sand there is an intricate channel only available at half tide, for boats and vessels of less than 6-feet draught, if well acquainted with the place, and in fine weather; for with strong westerly winds, which almost always cause a swell outside, there is certain to be a heavy breaking sea on the Monster Sand. It is a convenient passage for avoiding a long and laborious pull round the Pole and against a strong ebb tide over the bar.

Anchorage. A vessel can anchor outside the entrance to Exmouth anywhere near the fairway buoy, waiting tide according to her draught and the state of the weather, keeping eastward or westward of the buoy, according to the direction of the wind. The best anchorage within the entrance is on the western side of the harbor, above the town, in a hole of deep water and comparatively slack tide, called the Bight, between the low-water sands on the western shore and Bull-hill Bank, a high, hard gravel bank to the eastward. A black buoy marks the S. W. extremity of Bull-hill Bank, abreast which vessels may moor in 3 fathoms at low water.

The magnetic variation at Exmouth was $21^{\circ} 38'$ W. in 1870, diminishing at the rate of $7'$ annually. Magnetic variation.

It is high water, full and change, in Exmouth Harbor at 6h. 21m.; springs rise $12\frac{1}{4}$ feet, and neaps $8\frac{1}{2}$ feet. At Topsham lock the tide is 15 minutes later; the rise at springs being a foot less, and at neaps about the same as in the harbor. The tide begins to rise at Topsham about two hours after low water at Exmouth, when it has risen nearly a foot at the latter place. Tides.

Off Exmouth bar, $\frac{3}{4}$ mile south of Straight Point, at full and change, the stream turns to the eastward at 3h. 40m., and to the westward at 11h. 0m., running in the latter direction about $4\frac{3}{4}$ hours. The western stream, for the first two hours, runs W. S. W.; for the next two hours W., and then turns gradually to the northward. The direction of the eastern stream is E. N. E. for the first quarter; at half tide E. by N.; and the greatest velocity of both streams is about one knot.

Between Exmouth bar and Straight Point, throughout the ebb by the shore, the direction of the stream is E. S. E.; the tide is rotatory at that point.

At the entrance the flood makes soon after low water, and sets fairly up the channel until the banks are covered, at the rate of about a knot, increasing to $2\frac{1}{2}$ knots abreast the church, and to 5 knots off Ferry Point, decreasing considerably as the Bull-hill Bank is approached.

The ebb within the harbor turns with the tide by the shore, and for the first two hours sets across the Warren and Pole Sands; over the former it runs $2\frac{1}{2}$ knots until past Warren Point, when its strength decreases, and it crosses the Pole Sand at the rate of little more than a knot. The stream turns to the eastward when free from the influence of the harbor shoals. As the banks uncover, at about $2\frac{1}{2}$ hours' ebb, the tide sets fairly through the channel with considerable strength, at least 5 knots, abreast the Ferry; it crosses the outer end of the Pole Sand at the rate of about $1\frac{1}{2}$ knots, but when clear of the shoals it scarcely runs a knot.

When approaching the entrance of Exmouth Harbor from the southward bring Exmouth church on with the south-east house on Beacon hill, N. N. W. $\frac{1}{2}$ W., which will lead up to the fairway buoy. Directions.

The entrance should not be attempted without a pilot,

but with a leading wind, if compelled to do so, leave all the black buoys on the starboard, and the striped black and white buoys on the port hand. The channel is winding, and under any circumstances as little as 5 feet at low water must in all probability be crossed. The atmospheric engine-chimney at Starcross (a tall and conspicuous red tower) in line with Exmouth Point, N. N. W. $\frac{3}{4}$ W., will lead westward of the first striped black and white buoy on the Pole Sand, and up to the anchorage off the town.

To anchor in the Bight, the above course must not be continued farther than to bring Orcomb Point in one with the point below Gun cliff, near the coast-guard station, which bearing may be run on until the upper coast-guard boat-house, the first building northward of the baths, comes on with the ornamental villa called the Temple, remarkable from its Grecian design. These two in one will lead clear of the Warren and the Ridge. When the low point of Orcomb is observed to be coming on with the perch on the Checkstone, and the high tangent of Warren Point, haul to the northward for the Bight, and anchor by the lead, anywhere abreast the black buoy of the Bull-hill Bank. A pool of deep water runs up from the Bight to Starcross, in which vessels may lie in 6 or 7 feet at low water.

If approaching the entrance from the westward, after rounding Clerk Point and a remarkable rock outside it, called the Clerk, keep Exmouth church well open of Warren Point, N. E. by E., to pass eastward of the Dawlish Rock. Abreast Clerk Point, $\frac{1}{2}$ mile off shore, the fairway buoy bears E. by N., when it will be in line with Straight Point, and 4 miles distant. Between Clerk and Langstone Points the low-water rocks dry more than a cable-length off shore, with a gradually shelving bank outside them. A good turning mark up to the fairway buoy is to keep the whole of the town of Exmouth open of Warren Point, and not to open Mamhead tower northward of Langstone Point, which will avoid the Pole and shallow flat sands westward of it; but the soundings are regular, and common attention to the lead, making due allowance for the rise and fall of tide, will afford sufficient warning.

If entering from the eastward, steer for Straight Point, which may be rounded at a distance of $\frac{1}{4}$ mile, then keep Mamhead tower in line with the houses at Mount Pleasant,

which rises a little to the northward of Langstone Point, bearing about W. N. W. $\frac{1}{2}$ W. This, although a close mark, is a safe one with a fair wind for clearing the ledges between Straight and Orcomb Points, and also leads well inside the fairway buoy, and up to the fairway mark for entering the harbor.

As the entrance is not lighted, it cannot safely be attempted at night.

The village of Budleigh Salterton is about $\frac{3}{4}$ mile westward of Otterton Point, in a narrow dell running obliquely to the shore. Between the village and the point is the river Otter, a small rivulet, the mouth of which is 60 feet wide and 6 feet deep at high-water springs. When approaching the anchorage off the village, be careful to avoid the Foot Clout, a rock with 2 feet over it lying $\frac{1}{2}$ mile S. E. by S. of the Chapel; also Otterton Ledge, which runs off $\frac{1}{4}$ mile S. W. $\frac{1}{4}$ W. from Otterton Point. Budleigh Salterton.

The obelisk in Bicton park in line with the coast-guard watch-house on the shore, N. N. E. $\frac{1}{4}$ E., leads westward of the Foot Clout; and Sidmouth church open a quarter-point of the land east of Otterton Point leads in 3 fathoms water outside Otterton Ledge; but all the rocky ledges between Straight Point and Beer Head will be avoided by keeping $\frac{1}{2}$ mile off shore.

Sidmouth is $4\frac{1}{2}$ miles E. N. E. of Budleigh Salterton, in a valley running nearly at right angles to the coast between Salcombe Hill, 535 feet high, to the eastward, and High Peak, 500 feet high, to the westward. Sidmouth.

Beer Head is a lofty and precipitous chalk cliff, 426 feet high, the westernmost in England. On the eastern side of the head is a confined anchorage, sheltered from northerly winds. The best position for anchoring is with Beer Head W. $\frac{3}{4}$ S., and Beer village N. by W. $\frac{3}{4}$ W., in about 5 fathoms, sand. Beer Head.

Three miles south of Beer Head, at full and change, the stream of tide turns to the westward at 10h. 30m., and runs in that direction 4 hours, then gradually turns to the northward, and runs for 2 hours between W. N. W. and N. E. by N. It may be said to turn to the eastward at 5 o'clock, and for $2\frac{1}{2}$ hours, or until half-tide, sets from N. E. to E. by N., and for the next 3 hours gradually turns to the southward. The direction of the stream in this position is therefore round Tidal streams.

the compass, with little or no velocity, as even at springs it scarcely runs a knot, and that only for a short period.

Axmouth.

Between Beer Head and Haven Cliff, a conspicuous object from seaward, is the broad and fertile valley of the little river Axe, which has a small pier and landing quay at its mouth. The village of Seaton is a short distance westward of the pier. Under Haven Cliff is a dock which is said to accommodate vessels of 12-feet draught.

Lyme Regis.

Three miles eastward of Culverhole Point, and N. N. W. $\frac{3}{4}$ W. 22 miles from the Bill of Portland, is the small pier harbor of Lyme Regis, which dries at low tide and carries a depth of 9 to 12 feet at high-water springs. The Cobb or pier, a substantial stone structure, shelters small vessels within it from southwesterly gales; while the inner pier and north wall protect it from the swell caused by gales from the southeastward. The bed of the harbor being of hard marl, with only a surface coating of a few inches of mud, vessels occasionally strike heavily on taking the ground, particularly when a heavy sea outside causes a run within the pier. From the Cobb end, in the same line as the Cobb, there is a sharp point of loose stones, the outer end of which is marked by a beacon.

Life-boat.

A life-boat is stationed at Lyme Regis.

Lights.

On the inner pier-head is a fixed red light 11 feet above high water, and 275 yards N. W. $\frac{1}{2}$ N. from it; on the custom-house is a second fixed red light 21 feet above high water. They should both be visible in clear weather from a distance of 4 miles.

Tides.

It is high water, full and change, at Lyme Regis at 6h. 21m.; springs rise $11\frac{1}{2}$ feet, neaps $8\frac{1}{2}$ feet. A mile southward of the harbor the stream makes to the eastward at 4 p. m., and to the westward at 10 a. m., with an interval of slack-water; its greatest rate is only a knot.

Directions.

To enter the harbor at night, the high red light kept a little open eastward of the low red light, N. W. $\frac{1}{2}$ N., will clear the outer Cobb end, and lead to the inner pier-heads. By day steer for the beacon placed at the extreme end of the reef projecting from the outer pier-head, and give it a berth of 20 or 30 yards in passing. In strong southerly winds the sea breaks heavily round the piers; the proper place for a wrecked crew to take the beach would be at the

back or eastern side of the north wall, where the boat would most probably be driven.

High Ground and the Pollock are two rocky shoals, about $\frac{3}{4}$ mile apart, with 6 fathoms water between, lying westward of Bridport harbor. High Ground, the westernmost, lies W. N. W. $\frac{1}{2}$ W. $1\frac{1}{4}$ miles from Bridport pier-heads, and about $\frac{1}{2}$ mile off shore; it is $\frac{1}{2}$ mile long, $1\frac{1}{4}$ cable-lengths broad, and has only 9 feet water near its southeast end. The Pollock is nearly circular, about $1\frac{1}{4}$ cable-lengths in diameter; it lies W. by S. $\frac{3}{4}$ mile from the pier-heads, and has 11 feet over its shoalest head. High Ground
and Pollock
Shoals.

Puncknoll Knoll, a conical hill 587 feet high, with a small house on its summit, in line with the low end of the east and last cliff to the eastward of Burton coast-guard houses, S. E. by E. $\frac{1}{4}$ E., leads to the southward of both the High Ground and Pollock. Down Hall, a large white house in trees on the northern side of Bridport, on with Bridport pier-head, N. E. $\frac{3}{4}$ N., leads eastward of the Pollock; the west end of North Hill, 376 feet high, the first hill inland of Bridport east cliff, on with the pier-head, E. $\frac{3}{4}$ S., leads between the shoals; and Thorncomb peak, 509 feet high, N. E., leads to the westward of the High Ground.

The small but secure harbor of Bridport, $16\frac{1}{2}$ miles N. N. W. of Portland Bill, has 14 feet between the pier-heads at high-water springs, but the entrance dries at low tide. The piers are 50 feet apart, and form a straight canal-like entrance, in a N. E. $\frac{1}{4}$ N. direction for 700 feet, expanding into a secure basin, 530 by 145 feet, capable of containing about 30 such vessels as usually resort to the port. The clear space for entrance and egress is only 40 feet wide. During gales the sea breaks so heavily at the entrance that the harbor is unapproachable, and small vessels must then seek shelter in Lyme Regis. There is a building-yard, but only a few houses and stores at the harbor. The town of Bridport is $1\frac{1}{2}$ miles inland. Bridport.

A buoy is moored W. S. W. $\frac{1}{4}$ W. $1\frac{1}{2}$ cable-lengths from the pier-heads to assist vessels in warping in or out of the harbor. The usual course pursued in entering is to shoot between the piers, and be tracked into the harbor by men always in attendance at tide time. The best anchorage outside is abreast the piers, about $\frac{1}{4}$ mile off shore, in 3 or 4 fathoms, over fine sand; farther off the ground is foul.

Tides.

At the entrance of Bridport it is high water, full and change, at 6h. 5m.; springs rise $11\frac{1}{4}$ feet, neaps $7\frac{3}{4}$ feet.

West Bay.

West Bay, on the northwest side of Portland, is sheltered from winds between S. S. E. and N. by E., and is therefore frequently resorted to by coasters waiting tide to get around the Bill; but the water is deep, and it cannot be recommended as a safe anchorage for large vessels; for should the wind suddenly change to the westward a heavy sea soon gets up, and the holding-ground is bad, being loose gravel or shingle. There is anchorage in any part of the bay. Small vessels anchor off the south end of Chesilton village, $\frac{1}{4}$ mile off shore, in 8 or 9 fathoms, over clay bottom, with Portland high light-house touching Blacknor Point, S. S. W. $\frac{1}{4}$ W. Good shelter will be found about $1\frac{1}{4}$ miles off shore, in 17 fathoms, coarse gravel and shells, the Bill bearing S., and the abrupt shoulder of the Vern about E. $\frac{1}{2}$ S. Great caution is necessary, if at anchor in West Bay, to guard against a sudden shift of wind to the westward and southwestward, for such winds send in a heavy sea, against which few anchors would hold, and few vessels attempt to beat with any prospect of success; for although the tide sweeps strongly along the cliffs to the southward, its influence is too closely confined to the shore to produce any advantageous effect on vessels striving to gain an offing. A vessel may, however, between half flood and half ebb, work out of the anchorage with the wind to the southward of S. S. W.; and the attempt might succeed from half ebb to half flood provided the wind was northward of W. N. W.; but no reliance should be placed on this alternative, as a vessel on all occasions would be much safer at sea. Although there is no sensible in-draught into West Bay, a vessel embayed in a S. W. gale should keep off shore until the eastern stream makes, then with the assistance of the tide endeavor to round the Bill, and passing within the Shambles make for Portland harbor of refuge. If the western stream is running, and she cannot be kept off shore, attempt Bridport harbor, and if it cannot be entered beach the vessel close to the eastern side of the piers.

Tides.

At Chesilton, in West Bay, it is high water, full and change, at 6h. 13m.; springs rise $10\frac{1}{4}$ feet, neaps 7 feet.

In the middle of the bay the stream makes to the south-eastward at 1h. 40m., and to the northwestward at 10h.

46m.; setting toward the Bill 9 hours out of 12 with a velocity of 2 knots, which rate is rapidly increased as the Bill is approached. The duration of the northerly set does not exceed a couple of hours, and it runs with scarcely any appreciable force.

CHAPTER V.

BILL OF PORTLAND TO ST. CATHERINE POINT.

Bill of Portland. The Bill of Portland, E. $\frac{1}{4}$ S. 48 miles from Start Point, is the southeastern extremity of Portland peninsula, which is $3\frac{1}{2}$ miles long N. E. and S. W., and $1\frac{1}{2}$ miles wide near the center. The peninsula is connected with the adjacent coast by a narrow isthmus of coarse shingle, the eastern end of a remarkable raised beach known as Chesil Bank. The isthmus is 40 to 45 feet above low water, and 650 feet across from West Bay to Portland Road. The Vern, near the north end of the peninsula, is 488 feet above high water, and thence the land slopes gradually to the southwest, terminating in the Bill, 40 feet high; the whole presenting a remarkable wedge-like appearance, invaluable to seamen as a point of recognition in sailing up or down Channel.

Near the center of Portland is St. George's church, the top of which is 390 feet above high water, and, with the two wind-mills near it, is a useful sea-mark. The two white light-houses, about $\frac{1}{2}$ mile N. N. E. of the Bill, are also conspicuous objects. On the extreme point of the Bill a stone beacon, 20 feet high, with its summit 60 feet above high water, is placed to guard small vessels against a low shelf of high-water rock, the top of which has been quarried away for nearly 100 feet; large loose stones and masses of rock extend at least 150 feet beyond the point.

Lights.

The two light-houses near the south end of Portland are 50 and 85 feet in height, and 503 yards apart. They each exhibit a fixed bright light, and when in one, N. N. W. $\frac{3}{4}$ W., lead between the Race and the Shambles. The high light is 210 feet, and the low light 136 feet above high water, and in clear weather they should be visible from the respective distances of 21 and 18 miles. The low light is hidden by the land, except when bearing between E. S. E. and W. by S.

Portland Ledge.

Portland may be safely approached on all sides, but the soundings are irregular, particularly near the Bill, where a remarkable shelf of rock, called Portland Ledge, extends a mile in a S. S. W. direction from the pitch of the Bill, terminating in a sharp point. The inner part of the ledge is nearly a mile across, and it continues to flank the shore to the northeast for about $1\frac{1}{2}$ miles. The soundings over the ledge vary from 3 to 9 fathoms, breaking down suddenly on

the west side into 20 fathoms, on the south side into 18, and on the east side into 13 and 14 fathoms.

At the distance of $\frac{1}{4}$ mile from the Bill there is a depth of 5 fathoms, at 1 mile 10 fathoms, and at $1\frac{3}{4}$ miles 20 fathoms.

The tide runs with great violence round the Bill and over the ledge, causing fearful whirls and eddies in its progress; ^{Race of Portland.} but there is generally an eddy of still water a quarter of a mile wide between it and the land. In northerly winds the Race extends nearly 2 miles from the Bill, and there are great overfalls even beyond that distance; but with southerly winds it scarcely exceeds $\frac{1}{2}$ mile. During the north-eastern stream of tide, the overfall takes place to the eastward, and during the southwestern stream, to the westward.

During spring tides, which run at the rate of 5 or 6 knots, the agitation is so violent as to render it dangerous for small vessels to pass through the Race; and in tempestuous weather, during the northeastern stream, the whole space between Portland and the Shambles is one sheet of broken water. The turbulent sea thus created has, in some instances, so alarmed strangers as to induce them to bear up and run on shore at Chesil Beach, a fatal error, leading, in the majority of cases, to the loss of ship and crew. In fine weather even, the noise caused by the Race may be heard a considerable distance.

The Shambles is a dangerous bank of course sand, gravel, and broken shells, the western end of which—assuming the depth of 10 fathoms as its limit—bears from the Bill of Portland S. E. $\frac{1}{2}$ E. $2\frac{1}{4}$ miles, with an average width of $\frac{3}{4}$ mile. The depths on this bank are irregular, as there are several shoal heads with only 11 to 18 feet on them, and 5 to 7 fathoms between them. The least water, 11 feet, is near the middle of the shoal, from which St. George's church is in line with the south side of Church cove, N. N. W. $\frac{1}{4}$ W. The position of the Shambles is clearly shown, except at slack water, by a ripple or overfall on the north or on the south side, according as it may be flood or ebb. On the south side the bank rises suddenly from the depth of 10 fathoms into shallow and numerous heads with 2 to 5 fathoms water over them. The approach on the north side is more gradual; but as there are occasional shoal patches, it would not be safe for a vessel of great draught to stand into less

than 10 fathoms. The bank should, on no account, be crossed by vessels drawing more than 10 feet, and by small craft only in fine weather. When blowing hard the sea breaks furiously over it, and instances are known of small vessels having foundered on it.

Wyke Regis church open of the low northeast point of Portland, N. N. W. $\frac{1}{4}$ W., clears the east end of the Shambles; St. George's church open a quarter of a point westward of Portland wind-mills, N. $\frac{1}{4}$ W., leads over the western end in 8 fathoms; and the small chalk-pit, seen to the westward of a large figure of a man on horseback, cut out of the chalk on Osmington down, in line with the east point of Portland, N. N. E., will lead westward of the west end of the shoal, and between it and the Race.

Anvil Point, seen just clear of St. Alban's Head, E. $\frac{3}{4}$ S., will lead $\frac{1}{4}$ mile northward of the Shambles, and the point open 3° of the head, bearing E., $\frac{3}{4}$ mile to the southward. As Portland lights afford no guide at night for sailing outside this shoal, no vessel should then approach it within 20 fathoms.

Light-vessel.

The Shambles light-vessel, moored off the east end of the shoal in $14\frac{1}{2}$ fathoms at low water, exhibits, at an elevation of 38 feet above the sea, a fixed bright light, visible in clear weather from a distance of 10 miles. The vessel has one mast with a ball on its summit, and is painted red, with the word "Shambles" on her sides. A gong is sounded in foggy weather, and a gun fired if a vessel is seen standing into danger. From the light-vessel, Belfield house (in the trees) to the westward of Weymouth is between the piers of Portland breakwater, N. N. W. $\frac{1}{8}$ W.; the southern wind-mill at Portland is in line with the eastern point of Church cove, N. W. $\frac{1}{8}$ W., and Portland low light-house bears N. W. by W. $\frac{3}{4}$ W.

Tides.

It is high water, full and change, at 6h. 35m., and low water at 12h.; springs rise 9 feet, neaps $6\frac{1}{2}$ feet. Low water continues about 2 hours.

Two miles N. N. W. of the Bill of Portland, at full and change, the tide begins to turn at 6h. 35m., and sets as follows: 1st hour of the ebb by the shore at Portland breakwater, S. $\frac{1}{2}$ E., $1\frac{3}{4}$ knots; 2d hour, S. $\frac{1}{2}$ W., $1\frac{3}{4}$ knots; 3d hour, S. by W. $\frac{1}{2}$ W., $1\frac{1}{2}$ knots; 4th hour, S. W. by S., $\frac{3}{4}$ knot; 5th hour, N. W. $\frac{3}{4}$ N., weak; 6th hour, from N. N. W. to N

$\frac{1}{2}$ W., $\frac{3}{4}$ knot; 7th hour, N. N. E. to E. by N., 1 knot; 8th hour, S. E. $\frac{1}{4}$ E., $1\frac{1}{4}$ knots. 1st hour of the flood, S. E. by S., $1\frac{1}{2}$ knots; 2d, 3d, 4th, and 5th hours, S. S. E., 2 knots.

Near the west end of the Shambles the stream during the first hour of the flood by the shore sets W. $\frac{1}{2}$ to $1\frac{1}{4}$ knots; 2d hour, E. $\frac{1}{2}$ N., $\frac{1}{2}$ knot; 3d hour, E. by N., $2\frac{3}{4}$ knots; 4th hour, E. N. E. $\frac{3}{4}$ E., $3\frac{3}{4}$ knots; 5th hour, E., $3\frac{3}{4}$ knots. 1st hour of the ebb, E. by S., $3\frac{1}{2}$ knots; 2d hour, E. by S. to S. E. by S., $2\frac{1}{2}$ to $1\frac{1}{2}$ knots; 3d hour, S., 1 knot; 4th hour, S. W. by S., $1\frac{1}{2}$ knots; 5th hour, W. S. W. $\frac{1}{2}$ W., $1\frac{1}{2}$ knots; 6th hour, W. by S., 2 knots; 7th hour, W. by S., $2\frac{1}{4}$ knots; 8th hour W. S. W. $\frac{3}{4}$ W., $1\frac{3}{4}$ knots.

About a mile south of the Bill of Portland, at half-flood by the shore, the tide sets from S. S. E. to S. E. $\frac{1}{2}$ E., and the opposite stream about W. S. W. $\frac{1}{2}$ W.; the velocity of both streams being from 5 to 6 knots at springs; but although the tide runs with such violence near the Race, about a mile S. W. of the Bill it has been found weak.

At the east end of the Shambles the stream during the 1st hour of the flood by the shore sets W. $1\frac{1}{2}$ knots; 2d hour, from W. to N. by E., weak; 3d hour, about E. N. E., weak; 4th hour, E. by N., 2 knots; 5th hour, E. by N., $2\frac{3}{4}$ knots. 1st hour of the ebb, E. N. E., $3\frac{1}{2}$ knots; 2d hour, E. N. E., $3\frac{1}{4}$ knots; 3d hour, E. $2\frac{3}{4}$ knots; 4th hour, E. and E. by N., $1\frac{1}{4}$ knots; 5th hour, E., N. by W., and W. by N., weak; 6th, 7th, and 8th hours, about W., $2\frac{3}{4}$ to $2\frac{1}{4}$ knots.

About $2\frac{1}{2}$ miles west of the Bill of Portland, the flood and ebb steams are of nearly equal duration, setting S. S. E. and N. N. W. The eastern stream ends about 10 o'clock, which is $3\frac{1}{2}$ hours after high water in Weymouth harbor, or $1\frac{1}{2}$ hours before high water in Portsmouth Harbor. Five miles W. S. W. from the Bill the stream sets S. E. by E. and N. W. by W., and turns 30 minutes before high water in Portsmouth Harbor. Six miles S. S. W. of the Bill it sets E. S. E. and W. N. W., and the eastern stream ends 10 minutes before high water in Portsmouth Harbor.

The channel between the Bill of Portland and the Shambles should never be attempted by a sailing-vessel without a commanding breeze. The leading mark between the Race and the shoal is the small chalk-pit to the westward of the white horse on Osmington down in line with Grove Point, (the eastern point of Portland,) N. N. E.; but as the chalk-

Directions
Bill of Portland.

pit is a distant object, and not always sufficiently distinct to be identified, an equally good mark is the north end of Portland breakwater just open of Grove Point, on the same bearing. If coming from the westward keep in-shore immediately Portland Ledge is passed, as the eastern stream sets directly from the Bill for the Shambles.

Vessels bound to the westward with a westerly wind while the eastern stream is running, may turn to windward nearly up to the Bill by keeping near the eastern shore of Portland; but if they attempt to round the Bill before the tide slacks they will in all probability be swept off shore and carried through the Race. There is not less than 3 fathoms at the distance of a cable-length from this shore, but vessels of great draught should not approach within $\frac{1}{4}$ mile.

Between the Race and the Bill there is a useful channel, with from 3 to 9 fathoms water, which is frequently used by small vessels, particularly with a leading wind. If intending to run through from West Bay, weigh with the last of the ebb and steer for the high light-house, keeping the Bill rather open on the starboard bow, with which precaution, as the vessel nears the shore, the tide will sweep her round the point and within the Race; but if a course were shaped for the Bill in order to give it a berth, she would be caught in the strong tide. With a beating wind, work close up along the land, as it is bold to a cable-length. Although this passage is frequently used by small vessels, it should be borne in mind that there is a strong eddy or 9 hours' set on the eastern side of Portland, running in a different direction from the one out of West Bay. If, therefore, the vessel is so late in the tide as not to be able to get round Grove Point before the fourth hour of the flood, she had better anchor, to prevent being carried back again into the West Bay tide, or endeavor to get off shore to the eastward, into the fair flood stream.

At night the leading mark between the Shambles and the Bill is, the two lights in one, N. N. W. $\frac{3}{4}$ W., until the fixed red light on the breakwater bears N. by E. $\frac{3}{4}$ E., when steer for it, taking care to keep a safe offing on approaching Grove Point, and a prudent distance when passing the breakwater. During the eastern stream the higher light should be kept open to the westward of the lower one, as

that stream sets with great velocity over the Shambles; and as the western stream sets as strongly into the Race, similar precautions should be taken not to be set to the westward.

St. Catherine Point bears E. S. E. $\frac{1}{4}$ E. 44 miles from the Bill of Portland. In thick weather do not stand into less than 25 fathoms to avoid the in-draught caused by the flood running into Christchurch Bay, and toward the Needles and Freshwater Bay, the duration of which is considerably prolonged by southerly and southwesterly winds.

Bill of Portland
to St. Catherine
Point.

It is high water at one end of the Channel while it is low water at the other end; but this inversion of the tide is sudden, not progressive; for example, the Bill of Portland and St. Catherine Point are only 44 miles apart, yet it is high water at the latter when it is low water at the former; in fact the whole six hours' difference is confined within this space; the range of tide being nearly the same in both cases. It is therefore important for seamen to know that not only does this inversion take place somewhere near the assumed position of the Channel node or hinge of the tide at Swanage, which is equi-distant between these two places; but that at all places westward of the node it is high water nearly at the same time, between 5 and 6 o'clock, full and change, and at all places eastward of the node between 11 and 12 o'clock. As the tidal streams run everywhere in the Channel at high and low water on shore at Dover, or at 11h. and 5h., full and change, the western or outgoing stream drains all the harbors eastward of the node, while it is filling those to the westward, and *vice versa*, the same stream making a high or low water according as the position is east or west of the Channel node.

Tides.

From the time of half ebb to nearly the end of the flood, in Portsmouth Harbor, or from about 2h. to 11h., full and change, there is an outset from the West Bay of Portland of nearly 9 hours' duration, which closely skirts the rocky shore and gradually increases in strength as it approaches the Bill, where it acquires such velocity as to extend far beyond that point before it turns to the eastward, leaving a strong eddy stream between it and the land. Having assumed its easterly course, it rushes past the pitch of the Bill at the rate of 6 or 7 knots at springs, leaping and foam-

Eastern stream.

ing over the broken ground of Portland Ledge with great violence.

A short distance eastward of the ledge this outset is met nearly at right angles by a counter stream, which sets for 9 hours out of Portland Bay, running with great strength past Godnor Point; these united streams press on toward the Shambles, which they cross obliquely about east at the rate of $3\frac{3}{4}$ knots, clearly pointing out the limits of this bank by a well-defined line of broken water. At the west end of the bank the rate is quite $3\frac{1}{2}$ knots for three-quarters of the tide; at the east end the average rate is about 3 knots; but for the first hour there is scarcely any tide.

The eastern stream, when disentangled from the influence of the Shambles, sets in for the coast to the westward of St. Albans Head, soon, however, bending to the eastward in the direction of the shore, and sweeping round the head at the rate of 4 or 5 knots at spring tides. At $1\frac{1}{2}$ miles from Durlston Head the stream does not appear to set into Poole and Christchurch Bays, but within that distance it does so. A little farther off the head it runs for the Needles, and sets dangerously toward the Brook and Atherfield Ledges, which extend off the southwest shore of the Isle of Wight. At $2\frac{1}{2}$ miles off Durlston Head the stream sets in a slight curve outside St. Catherine Point, which it passes at about the same distance, having regained the velocity it had off St. Albans Head, upward of 4 knots.

nuer stream.

Within the stream just described, there is during the flood a stream which a half mile from the Shambles sets dangerously into the bight toward the Kimeridge ledges, brushing sharply and closely round St. Albans Head, whence it is deflected to the northward round Durlston and Peverel Points, but with decreased strength, and having passed Old Harry, expends itself in Poole Bay. Thence it proceeds slowly round the bay toward Christchurch Head, running smartly over Christchurch Ledge, but soon relapses into its former tranquil course; as it approaches the Needles, however, it acquires increased strength, and runs over the Dolphin Bank and the Shingles with considerable velocity. This stream splits off the Needles, one portion running up the Solent and through Spithead, while the other flows round the south side of the Isle of Wight, following every bend and turn of the coast.

The reverse of the foregoing remarks is applicable to the Western stream. course of the outgoing or western stream, which $4\frac{1}{2}$ hours after the commencement of the eastern stream in the offing, or at 9h. 30m. on full and change days, has made in-shore the whole way from Selsea Bill, through Spithead and the Solent, to Portland. It may, however, be requisite to repeat that at any moderate distance from St. Albans Head, from 1 to 2 miles, this stream sets for the Shambles, whereas its in-shore portion runs smartly along the coast as far as Whitenore Point, losing its strength in Weymouth and Portland Bays. From the northeast end of Portland it rushes furiously round Godnor Point toward the Shambles and past the Bill, catching up the first of the outset to the southeast out of West Bay in its course down Channel.

From the above description of the in-shore streams it will Caution. be seen that there is a considerable in-draught on both the flood and ebb into all the deep bights on this part of the coast, particularly on the flood, round Durlston Head into Poole Bay, and in some positions more than others, according to the distance off shore. This in-draught tends to lead a vessel into danger, particularly in thick weather, if by neglecting the lead she is allowed to be attracted within its influence. With the land in sight, there can be but little risk of this, for anywhere southward of the Shambles, $1\frac{1}{2}$ miles outside St. Albans Head, or 2 miles south of St. Catherine Point, a vessel will not be materially affected by the in-draught on either tide.

At night or in thick weather suspicion should always be awakened by the appearance of a strong race or overfall, as it indicates either the near approach to some salient point, or proximity to a shoal; and it may be generally inferred that 2 miles outside the fair streamage of headlands there is little or no in-draught.

The in-shore stream of flood, as mentioned above, splits off Second high water. the Needles, one part flowing round the south side of the Isle of Wight, the other through the Solent and Spithead. At $4\frac{1}{2}$ hours after the commencement of the offing stream, or at 9h. 30m. on full and change days, the western stream has made in-shore all along the coast from Selsea Bill through Spithead to the westward, increasing its velocity down the Solent to nearly 2 knots, and through the Needles Channel to $3\frac{1}{2}$ knots. This western stream unites with the last of

the flood round the eastern side of the island, and together they run through Spithead, giving increased effect to the incoming stream of flood, by contributing to fill the harbors in its progress to the westward, until the stream has turned in the offing, a little after 11 o'clock, thus making a flood or rising tide of 7 hours.

This not only affects the rise of tide in Portsmouth, Langston, and Chichester Harbors, but it makes what is called a second high water in the harbors of the Solent. At Christchurch, Poole, and Swanage it is more properly a second rise, as it takes place between high and low water. This second flow occurs at Southampton and Hurst 2 hours, at Christchurch $2\frac{1}{2}$ hours, at Poole $3\frac{1}{2}$ hours, and at Swanage 4 hours, after the first high water. The influence of the second tide continues to be felt as far as Portland, but to the westward of St. Albaus Head it comes so near the time of low water, and causes so small a rise, that it is called the second low water; the intermediate rise of 5 to 7 inches being termed the gulder. This second rise or swelling of the tide ceases about 12h., full and change, or about the time that the outgoing or western stream in the Channel has acquired strength.

Portland Har-
bor.

Portland Road offers a secure refuge harbor easy of access by night or day, being sheltered by the breakwater from winds between E. and S. The breakwater runs out 2,000 feet in an easterly direction from the northeast end of Portland to an opening 400 feet wide, and thence curves round and takes a N. N. E. $\frac{1}{2}$ E. direction for 7,000 feet to its northeast extremity, inclosing an area of about 4,310 acres, varying in depth from 3 to 9 fathoms. The area included in the harbor without the 5-fathom line is 1,430 acres, in the whole of which the largest ships may anchor over clay bottom, sheltered from all winds, but during southerly gales the wind frequently flies suddenly round to the N. W., blowing in heavy gusts over Chesil Bank, and causing a short unpleasant sea dangerous for boats. Vessels may ride with great safety at single anchor, as there is no tide except near the opening of the breakwater. If obliged to moor, have the house open to the northward, with the small bower to the prevailing westerly winds, a good scope of cable out, and in winter the sheet-anchor ready.

At $1\frac{1}{2}$ miles from the north end of Portland a timber bridge

connects Chesil Bank with the coast, at the entrance of a remarkable salt-water lake, called the Fleet Water, which runs at the back of the shingle beach as far as Abbotsbury. From the Fleet the shore rises gradually to the Nothe, which is 75 feet high. On a projecting point between the bridge and the Nothe is Sandsfoot Castle, whence the shore is fringed with low-water rocks, all of which will be avoided by keeping the coast-guard houses at Preston open of Nothe Point.

On the outer ring of the fort, at the northeast extremity of the breakwater, and 30 feet above high water, is exhibited a fixed red light, which should be visible in clear weather from a distance of 9 miles. Vessels should not approach the light within a cable-length. Light.

The magnetic variation in Portland Road was $21^{\circ} 8' W.$ in 1870; decreasing at the rate of $7'$ annually. Magnetic variation.

It is high water at the breakwater, full and change, at 7h. 1m.; springs rise $6\frac{3}{4}$ feet, neaps $4\frac{1}{2}$ feet. The first low water is 5 hours after high water, and the second 3 hours later. Tides.

With the Shambles light-vessel or light in sight there is no difficulty in approaching Portland Harbor by night or day. It will, however, be requisite during the western stream, especially in light winds, to give the east end of the Shambles a wide berth by keeping Wyke Regis church well open of the northeast end of Portland, to insure not being swept over that shoal, which has in many cases proved fatal. After passing this danger steer for the breakwater light on a N. by W. $\frac{1}{2}$ W. bearing, and give it a berth of not less than a cable-length in rounding. Anchor as convenient, according to the vessel's draught. Merchant-vessels should anchor westward of a line between two white-washed marks near the harbor-master's office and the Nothe. Directions.

Weymouth Road, between the Nothe and Redcliff Point, is open only to winds between E. and S., and is frequently resorted to in the summer, and in fine weather. The usual anchorage is about a mile off the town in 5 to 8 fathoms, over sand and gravel. Vessels should not anchor within three-quarters of a mile from the northern shore of the road, as the ground there is foul. Weymouth.

The little river Wey divides the towns of Weymouth and

Melcombe Regis, and falls into Weymouth Road on the northern side of Nothe Point, from which a stone pier runs out E. N. E., continued 370 feet farther by a breakwater of loose stones which cover at high water; its outer end is marked by a buoy. The north side of the entrance is protected by a stone pier running out E. by S. from the south end of the esplanade of Melcombe Regis, and from its outer end a pile pier extends 300 feet. The harbor carries 7 feet at low water, and 14 feet at high-water springs. A swing bridge connects the towns of Weymouth and Melcombe Regis, above which is a large pool called the Back Water, where yachts and small craft are laid up during winter. There are patent slips and building-yards at Weymouth, and a tank on the north quay, where vessels are supplied with water at the charge of 4s. per ton.

Lights. Near the beach to the eastward of the railway station are two fixed red lights, 30 feet and 20 feet above high water, bearing N. N. W. and S. S. E. from each other. On the north pier of Weymouth Harbor are two fixed green lights, 20 feet high, bearing E. $\frac{3}{4}$ N. and W. $\frac{3}{4}$ S. from each other.

Directions. When approaching Weymouth Harbor, keep St. John's church at the north end of Melcombe Regis open eastward of the pile beacon, N. $\frac{3}{4}$ W. to clear the Mixen Rocks, which run off nearly a cable-length eastward from Nothe Point; these and the rocks extending about 180 feet from the north-east point of the Nothe to the beacon are the only dangers to avoid in entering the harbor. Give the buoy a berth of about 200 feet in rounding, on its eastern side, and keep in mid-channel until the vessel is abreast the outer south quay. She will then be within the northern jetty, and past the rocks running out from the Nothe, after which the deepest water is on the south side of the harbor.

At night after passing the Portland breakwater light bring the two red lights at Weymouth in line, N. N. W., and keep them on until the two green lights on Weymouth pier are in line, W. $\frac{3}{4}$ S.; this latter range leads in through the deepest water until close to the north-pier lights, which may be passed close to, and thence a mid-channel course up the harbor should be pursued.

Weymouth to
Lulworth.

The coast from Weymouth curves round to the north-east, and is low and flat to the north shore of Weymouth

Road. Jordan Hill, in the northern part of the road, rises with an even slope to about 160 feet, and eastward of the hill commences a series of low cliffs intersected by steep ravines. Redcliff Point, the westernmost of these cliffs, is 150 feet high. The cliffs gradually increase in height to Whitenore Point—chalk over green sand—where they are 542 feet above high water. The land rises from the cliffs to the downs, and on Osmington Down, $1\frac{1}{2}$ miles from Redcliff Point, is the large figure of a man on horseback cut out of the chalk, showing white on the green slope of the hill, and visible for many miles seaward. Between Weymouth Road and St. Albans Head the shore is chiefly of chalky cliff. On this part of the coast the tide runs with little strength.

There is a stream of fresh water and good facilities for watering in the small boat harbor at Osmington mills, a short distance westward of Ringsted Point; the west point of entrance is marked by a beacon. Water.

There are several rocky ledges bordering the coast on the north side of Weymouth Bay. Those off Ringsted Point are low flat ledges of indurated clay, extending $\frac{1}{3}$ mile from shore, with only 10 feet water over their outer end. Lodmoor farm just open of the base of the cliff at Preston coast-guard house, N. W. $\frac{1}{2}$ W., leads south of all the foul ground from Redcliff Point to Whitenore Point. Between the latter and Warbarrow Head the shore is generally bold, but there are a few outlying rocks, which will be avoided by keeping Swyre Barrow Hill (674 feet high) open of Broad Bench Point, S. E. by E. $\frac{1}{2}$ E. Ringsted Ledges.

Lulworth Cove, 3 miles eastward of Whitenore Point, is a little circular basin begirt by high cliffs of chalk and sand, which, in cases of necessity, would afford shelter to small vessels. Water may also be obtained there. The clear entrance is about 250 feet wide, between ledges of low-water rocks running off from each point; the longest ledge being on the western side. In entering keep one-third over from the eastern cliff. Within the cove there is 12 feet at low-water springs. The first low water takes place $4\frac{1}{2}$ hours after high water; the gulder then rises for $1\frac{1}{2}$ hours, and the second low water occurs 2 hours after the gulder has ceased rising. Springs rise 7 feet, neaps $4\frac{1}{2}$ feet. Lulworth Cove.

Warbarrow Bay is a mile eastward of Lulworth Cove, and shelters from winds between W. by N. and S. E. by E. Warbarrow Bay.

It is about $1\frac{1}{4}$ miles wide, and $\frac{1}{2}$ mile deep, and is compassed by high cliffs cleft in the center by Arish Mill Gap. The best anchorage is between this gap and Warbarrow Head, $\frac{1}{3}$ mile off shore, in 5 to 7 fathoms, fine sand. Water can be obtained at Arish Mill Gap.

Between Warbarrow and St. Albans Head are two coves named Kimeridge Bay and Chapman's Pool, but neither affords safe anchorage.

Kimeridge
Leiges.

From Warbarrow Head to St. Albans Head the coast consists of a succession of dark-looking cliffs, fringed by long flat ledges of indurated clay, some of which extend a half mile off shore. Arish Mill Gap open of Warbarrow Head, N. W. by N., leads outside them. Arish Mill Gap will be known by its white sandy beach; Warbarrow Head by the small conical hill on its summit.

St. Albans
Head.

St. Albans Head, from which the Bill of Portland bears W. $\frac{3}{4}$ N. $15\frac{1}{2}$ miles, and St. Catherine Point E. S. E. $28\frac{1}{2}$ miles, is a bold headland 359 feet high, on the summit of which is an ancient chapel or chantry. It has generally a race running off it, particularly in blowing weather, caused by the unevenness of the ground. The overfalls extend about a mile off shore, and are sometimes found more westerly, and sometimes more easterly, according as the wind and tide act in concert with or against each other. There is not less than $5\frac{1}{2}$ fathoms water in the vicinity, with 12 and 15 fathoms on both sides as well as to the southward.

Tides.

At $1\frac{1}{4}$ miles S. S. W. $\frac{1}{2}$ W. from St. Albans Head the western stream makes at 10h. 45m., full and change, and the eastern stream at 4h. 45m., the latter setting S. E., and the former W. N. W. to N. W. by W., their greatest velocity being about $4\frac{1}{2}$ knots at half tide.

St. Albans
Head to Swan-
age.

Between St. Albans and Durlston Heads is a clear bold shore of dark-looking limestone cliffs, the quarries of which are extensively worked. At Durlston Head the coast bends abruptly to the northward, forming the western shore of the deep inlet between St. Albans Head and St. Catherine Point.

One mile S. E. of Durlston Head the western stream makes at 10h. 25m., full and change, and the eastern stream at 4h. 25m., the former setting W. S. W. and the latter E. N. E.; their greatest velocity is about 3 knots; the in-

draught on the flood is dangerous in thick weather if not guarded against.

Several rocks lie between Durlston Head and Peverel Point, and vessels passing should not bring the head to the southward of S. W. by W. $\frac{1}{2}$ W., nor approach the point within $\frac{1}{3}$ mile, until Swanage church comes well open of the northern shore of Peverel Point, W. N. W. Old Harry, a pinnacle rock off Standfast Point, in line with Poole Head watch-house, which stands in the northwest angle of Poole Bay, N. by E. $\frac{3}{4}$ E., leads $\frac{3}{4}$ mile outside Peverel Ledge, which extends some distance off Peverel Point, and over which a tide race runs with considerable strength.

The anchorage in Swanage Bay is not much used, except by small vessels, which anchor in fine weather on the south side of the bay in 4 to 6 fathoms, fine sand, $\frac{1}{2}$ or $\frac{3}{4}$ mile off shore. A pier 273 yards long, and 18 feet wide, provided with cranes for shipping stone, runs out in an easterly direction, with 18 feet at high-water springs at its outer end. The shores of the bay rise with a gradual slope from the sea, and at the north point is the east end of the chalk range that extends across the country from Whitenore to Ballard down, terminating in white cliffs, which re-appear at the Needles.

Swanage.

There is a life-boat at the island of Purbeck.

Life-boat.

At Swanage the first high water, full and change, is at 8h. 20m., the second rise at 12h. 20m., and low water at 3h. 20m.; springs rise $6\frac{1}{2}$ feet, neaps $4\frac{1}{2}$ feet.

Tides.

At $\frac{1}{3}$ mile E. S. E. of Peverel Point the western stream makes at 8h. 40m., full and change, and the eastern stream at 4h. 0m., the former setting S. W., and the latter N. E.; on the ebb there is a dangerous race over the ledge, which extends about a mile off the point. The velocity of the ebb is about 3 knots, that of the flood about $1\frac{1}{2}$ knots. Off Old Harry, at $\frac{3}{4}$ mile N. E. by E. from Standfast Point, the western stream makes at 9h. 45m., and the eastern stream at 4h. 10m., the latter setting N. E. by E. to N. by E. at the rate of 1 knot, and the western stream S. by W. to S. W., 2 knots.

The shore from Ballard Point to Standfast Point should not be approached within $\frac{1}{4}$ mile. Off Standfast Point are the two remarkable chalk pinnacles, called Old Harry and Old Harry's Wife, and on the north side of it is Studland

Studland Bay.

Bay, which affords good shelter for small vessels during westerly winds. The best anchorage is off three remarkable projections in the chalk cliff, called the Yards, in about 2 fathoms, with the Agglestone—a large square rock on a small hill $\frac{1}{2}$ mile inland—open northward of the coast-guard buildings on Redend Point, W. N. W. $\frac{1}{4}$ W., and Shepherd's hut S. S. W. Large vessels anchor farther out, according to their draught, with Studland church bearing W.

Poole.

From Studland to Poole Head is a range of hillocks of drift sand, and between them is the entrance to Poole Harbor, which is $1\frac{1}{2}$ cable-lengths wide, the navigable channel being not more than half that distance across. The harbor is a capacious estuary, resembling at high water an inland lake, which branches in every direction into the heaths surrounding it. Its navigable channels being narrow and intricate, and its entrance fronted by shifting sands, it should not be attempted without a pilot.

The town of Poole, on the north shore of the harbor, 3 miles from the entrance, has capacious quays. Wareham is 5 miles above Poole, between the rivers Trent and Frome, which unite 1 mile below. The channel through the Frome or South River is navigable to Wareham quay for vessels of 20 or 30 tons.

Life-boat.

A life-boat is stationed at Poole.

Lights.

On the south part of North Haven Point, at the entrance to the harbor, are two fixed bright lights on lamp-posts; the low light is 16 feet above high-water, and the high light, N. $\frac{1}{4}$ W. 262 yards from the low light, is 37 feet above high water. Both should be visible in clear weather from a distance of 6 miles. The low light is masked when bearing between N. $\frac{1}{2}$ E. and N. by E. $\frac{1}{4}$ E. There is also a bright light on North Haven Point within the entrance near Lilliput farm, and at the town are two red lights.

Magnetic variation.

The magnetic variation was $20^{\circ} 53'$ W. in Poole Harbor in 1870, decreasing at the rate of $7'$ annually.

Tides.

Owing to the double high water in Poole Harbor, the tide stands at a high level for about $3\frac{1}{2}$ hours. At Brownsea Island, on full and change days, the first high water is at 8h. 50m., the second rise at 12h. 25m., and low water at 3h. 50m.; springs rise $6\frac{1}{2}$ feet, neaps $4\frac{3}{4}$ feet, but both are very uncertain. At Poole quay the first high water is 20 minutes later than at Brownsea, but the second rise and low water

are simultaneous at both places, and the rise and fall are the same. At Russell quay, half-way between Poole and Wareham, the first high water is 40 minutes after that at Brownsea, and the second rise and low water are 20 minutes later; the rise and fall are the same. At Wareham quay the first high water is 1h. 25m., the second rise 1h. 15m., and low water 1h. 25m. later than at Brownsea; springs rise 4 feet. From the great extent of mud-lands over which the tide flows, and the great number of streams that fall into Poole Harbor, the tide rushes with great force through the narrow opening at the Haven Points, and has there scoured out a channel with a depth of 6 to 8 fathoms at low water.

The approach to Poole Harbor, between the banks fronting its entrance, is narrow and intricate, and though great attention is constantly paid to buoying and lighting the channel, only necessity can justify a stranger in attempting to enter without a pilot, who is always in attendance in Studland Bay. Directions.

The best and, indeed, the only buoyed channel into Poole Harbor is that known as the Swashway, which has been increased in width and depth by the extension of a break-water from the shore in the vicinity of South Haven Point, in order to arrest the ebb current in its passage to the sands and flats of Studland Bay, and direct its course so as to scour this channel. The least known depth in the Swashway is $6\frac{1}{2}$ feet, and as the rise at springs is $6\frac{1}{2}$ feet the depth at high water will then be 13 feet. The starboard side of the channel on entering is marked by black can-buoys, and the port side by cask buoys striped red and white vertically; the third buoy on the port side being distinguished by a staff and ball. The lights on North Haven Point in line, N. $\frac{1}{4}$ W., lead through the Swashway. From Brownsea Castle the channel is clearly pointed out by buoys striped red and white vertically, to be left on the port hand, and perches on the mud-bank on the starboard hand. The Middle Ground has a ball beacon on its southern end, which must be left to port, and a red buoy on its upper end; from thence the channel is marked by perches on each side to Poole Creek, which has a black buoy on the starboard side of the entrance, and a beacon on the port side. The main channel above Poole, to Wareham, is marked by perches on each side, and buoys at the first

curve; the buoys striped red and white vertically are to be left to port, and the black buoys to starboard.

If compelled to enter at night, the lights in line N. $\frac{1}{4}$ W. will lead through the Swash, and up the channel to the Haven Points; after which keep in mid-channel, and anchor off Brownsea castle.

Poole Bay .

At Poole Head the coast curves to the eastward, and thence to Hurst Point is a succession of earthy cliffs intersected by deep ravines, called chines, worn away by the action of small streams. From the soft, yielding nature of the shore, the action of numerous springs, and the violence of the waves, the sea is encroaching on the whole of this part of the coast, as is evidenced by frequent land-slips, and the fall of inclosures, fields, roads, and houses, over the cliff.

In the southern part of Poole Bay the ground is clear, and there is an open anchorage in 6 to 7 fathoms, sand and gravel, with Studland church bearing W. $1\frac{1}{2}$ miles. In the northern part of the bay are several patches of dangerous rocks, with 6 to 7 fathoms between them. The shoalest head, with only 8 feet water, named Inner Poole Patch or Woodbury Rock, lies $\frac{1}{2}$ mile off Poole Head; and another, the Outer Poole Patch, with 16 feet, is nearly $1\frac{1}{2}$ miles from the Bournemouth shore. The Arne trees, (a remarkable clump on a hill 178 feet high, near the head of Poole Harbor,) on with North Haven Point and well open south of Brownsea Island, N. W. by W., leads southward of these dangers; and the whole of Swanage well open of Ballard Point, S. W. by W. $\frac{1}{2}$ W., leads eastward of them.

Bournemouth.

Bournemouth is in a valley 2 miles eastward of Poole Head. A pier runs off 267 yards from the shore, alongside the head of which there is 14 feet at high-water springs.

To the westward of Bournemouth the ground is foul, and nearly $\frac{1}{2}$ mile off shore are the Bournemouth Rocks, with 14 feet water. Inside them is Darby Rock, with 8 feet. Brownsea castle kept open of the base of Poole Head, W. $\frac{1}{2}$ N., leads southward of this foul ground, and Durlston Head open of Old Harry, S. W. $\frac{1}{4}$ W., leads eastward of it. Between Bournemouth and Christchurch Ledge there are no outlying dangers, and the shore may be approached to a distance of $\frac{1}{3}$ mile.

Christchurch
Ledge.

Christchurch or Hengistbury Head, 120 feet above high

water, is six miles eastward of Poole Head. It is composed of dark reddish-looking ironstone, and, being of harder material than the coast to the westward, gives way more slowly to the action of the numerous springs and the violence of the waves; but even here it was shown, by actual survey, that 300 feet had gone from the point of the Head between 1847 and 1854; this distance has since been considerably increased by the removal of large quantities of ironstone from the face of the cliff.

A narrow rocky ledge runs $2\frac{3}{4}$ miles S. S. E. $\frac{1}{4}$ E. from Christchurch Head, near the middle of which, $1\frac{1}{4}$ miles from the Head, a black buoy is moored in 3 fathoms; but there is only $2\frac{3}{4}$ fathoms on the end of the ledge at twice that distance from the shore. The tower of the Priory church at Christchurch, just open eastward of the coast-guard watch-house on Christchurch Head, N. by W. $\frac{1}{4}$ W., leads along the west side of the outer part of the ledge. Node's beacon, on the Isle of Wight, in line with the junction of the red and white cliffs in Alum Bay, E. S. E. $\frac{1}{4}$ E., leads southward of the ledge and Dolphin Bank up to the fairway of the Needles Channel.

The entrance to Christchurch Harbor is $\frac{3}{4}$ mile N. N. E. of Christchurch Head. It is accessible to small vessels only, being obstructed by a bar of drift-sand with but 6 feet over it at high-water springs. The town of Christchurch is $1\frac{1}{2}$ miles within the entrance, a little above the junction of the rivers Avon and Stour. The tower of Priory church, 131 feet above high water, is a conspicuous object from seaward.

At Christchurch the first high water, full and change, occurs at 9h. 0m., the second rise at 11h. 30m., and low water at 3h.; springs rise 3 feet at the town, 5 feet at the entrance, and 7 feet outside the bar. After the first high water the tide falls nearly $1\frac{1}{2}$ feet, and then rises again about 9 inches. From the entrance points to the bar, both tides run with great velocity. Between the last quarter ebb and the first quarter flood the water is fresh within the points.

No stranger should attempt to cross the bar without a pilot. As none but vessels of light draught can require to round the eastern end of Christchurch Ledge in order to reach Christchurch Bay, they may pass close to the buoy

Christchurch
Harbor.

Directions.

NEEDLES CHANNEL.

in $2\frac{1}{2}$ fathoms. A clump of trees, on a distant hill, open west of High Cliff trees N. by E. $\frac{1}{2}$ E., or High Cliff house N. N. E. $\frac{1}{2}$ E., crosses the ledge in $2\frac{1}{2}$ fathoms. High Cliff house, N. $\frac{1}{2}$ E., leads over the tail of the Dolphin Bank in $4\frac{1}{2}$ fathoms, and eastward of the ledge in 6 fathoms, to the anchorage off Christchurch in about 3 fathoms, sand and mud, with Priory church in line with the Haven house, and Durlston Head open of Christchurch Head.

Needles Channel.

The land about Christchurch Bay is low, especially in the vicinity of Hurst castle, the base of which is but little above the sea-level. The Needles Cliffs, at the western extremity of the Isle of Wight, rise perpendicularly from the sea, and being composed of white chalk are remarkable from the offing when contrasted with the dark-colored ground behind them; these, with the white light-house on the Outer Needle Rock, Hurst castle, the batteries, and two light-houses on Hurst Point, are good guides to the entrance of the Needles Channel, between the shoals called the Shingles and the Isle of Wight. This entrance, between the west end of the Bridge Reef and the southwest tail of the Shingles, is nearly $\frac{1}{3}$ mile wide, the least depth being 5 fathoms over gravel. With care it may be taken, under favorable circumstances, by sailing-vessels of great draught, and by steamers at any time when the leading marks or lights are visible.

With the wind between S. E. by S. and N., a sailing-vessel under most circumstances may take the channel with confidence; but if the wind be to the eastward of S., the channel should not be attempted in ships of great draught, for the course past the S. W. buoy of the Shingles, until within the Bridge reef, is no better than E. $\frac{1}{2}$ N., and on entering the channel the wind generally draws more to the eastward. With scant southeasterly winds it should never be attempted on the ebb; and as a general rule it cannot be recommended to beat through, except in a handy vessel of light draught, under the management of a good pilot, when it is not a hazardous evolution on the flood. With a smooth sea, vessels of moderate draught may cross the Bridge reef with Hurst light-houses in line by day, and the lights in line at night, bearing N. E. by E. $\frac{1}{2}$ E.; but if drawing 19 or even 18 feet these marks should not be used at low-water springs, as they would lead too close to the

shoal water on the reef. Although the lead should on no account be neglected, it will be of little service, for the tide hustles a vessel so quickly through the channel that the seaman has scarcely time to avail himself of any warning it might afford; but a marked attention to the soundings is of the utmost importance when approaching the entrance from sea. As a general rule, from whatever quarter this channel is approached, with the Hurst lights in sight—and it should never be attempted by a stranger unless they are—the seaman may be assured that he is nearing the entrance when the depths are under 10 or 11 fathoms, according to the state of the tide, and that even these soundings will bring the vessel close to the rocks if the lights are northward of N. E. by E.; great caution must therefore be used in approaching the Bridge reef until the lights are eastward of that bearing, and the anchor clear for letting go at a moment's warning.

On the outermost of the Needle Rocks is a circular granite light-house 109 feet high, which exhibits, at an elevation of 80 feet above high water, a fixed light of the first order, red when bearing between N. W. $\frac{1}{2}$ N. and E., bright from E. to E. S. E., red from E. S. E. to S. W. by W., and bright from S. W. by W. to S. W. by W. $\frac{1}{2}$ W. The bright light is visible in clear weather from a distance of 14 miles, and the red light 9 miles. A bell is sounded during fogs. The bright light shows in the direction of the entrance of the Needles channel, its southern limit, when bearing E., passing $1\frac{1}{2}$ miles south of Durlston Head, and about a cable-length south of the outer part of Bridge reef; while its northern limit, E. S. E., passes 2 cable-lengths south of the Dolphin bank and the S. W. buoy of the Shingles. The ray of bright light between the bearings S. W. by W. and S. W. by W. $\frac{1}{2}$ W. clears the Warden Ledge.

Needles light.

In the fort on Hurst Point is a circular red light-house, 52 feet high, which exhibits a fixed bright light 46 feet above high water, and 223 yards N. E. by E. $\frac{1}{2}$ E. from it a circular white light-house 85 feet high, exhibiting a fixed bright light at an elevation of 76 feet. Only the top of the red tower is visible, but a red screen outside the fort renders it apparently complete when the light-houses are in line. The lights should be visible in clear weather from the respective distances of 10 and 13 miles; they are shut in by the Needle Rocks when bearing northward of N. E. $\frac{1}{2}$ E. In the

Hurst lights.

eastern face of the high light-house there is a fixed bright leading light, which shows up the Solent when bearing from W. S. W. $\frac{1}{2}$ W. to W. N. W. $\frac{1}{2}$ W.

The Shingles. The northwestern extremity of the Shingles is about $\frac{1}{2}$ mile from Hurst beach; it extends thence W. S. W. nearly 3 miles, terminating in two prongs, the southwestern of which is very dangerous, having only 5 feet over it at low water. The northern side of the shoal, except near the western or outer end, is of gradual slope, and the approach to it may be tolerably well ascertained by careful attention to the lead; but the southern or channel side is steep-to, dropping at once from almost a dry bank to a depth of several fathoms. Caution is requisite in approaching either side, for the numerous shallow heads, the rapidity of the tides, and the violence with which the sea curls and breaks with the least swell, would entail certain destruction to any vessel which might be driven on them.

The crown of the bank, or the part subject to the wash and surface scour of the tide, is continually changing according to the state of the weather, and after a long continuance of easterly winds and smooth water high banks are heaped up which are never wholly covered, and which usually disappear after strong southerly winds, when the surface frequently becomes so completely leveled as to leave no part visible even at low water. There is no proof, however, that the main body of the shoal is subject to any alteration of consequence either in figure or extent. On the flood the overfalls may be distinctly seen on the southern edge, and during the ebb the ripple on the northern edge.

Milford church seen between the two western houses of Milford, N. E. $\frac{1}{4}$ E., leads clear of the western side of the Shingles, and eastward of the east end of the Dolphin Bank, the shoalest part of which lies in 3 fathoms, N. W. $\frac{1}{4}$ N. $8\frac{1}{2}$ cable-lengths from the S. W. buoy of the Shingles.

Nodes beacon on with the junction of the red and white cliffs in Alum Bay, E. S. E. $\frac{1}{4}$ E., leads south of the Dolphin, and the southwest prong of the Shingles. The Hurst light-houses in line, N. E. by E. $\frac{1}{2}$ E., clears the southeastern side of the Shingles, but leads close to it eastward of the Elbow buoy, after passing which the high light-house must be opened southward of the low one.

Shingles buoys. There are three buoys on the channel side of the Shingles;

one off the southwest prong, another at the elbow, and the third at the northeastern extremity.

The S. W. Shingles buoy is conical and checkered red and white. It is moored in 7 fathoms, with Hurst high light-house, its own breadth open north of the low light-house, N. E. by E. $\frac{3}{4}$ E.; Nodes beacon in line with the western part of the variegated cliff in Alum Bay, E. S. E. $\frac{1}{4}$ E., and the Elbow buoy N. E. by E. $\frac{3}{4}$ E. 1.4 miles.

The Elbow buoy is a can-buoy with red and white vertical stripes. It is close to the edge of the bank in 7 fathoms, with Hurst high light-house, one and a half times its breadth open north of the low light-house, bearing E. N. E. northerly, Needles light-house S. S. W. $\frac{1}{2}$ W., and N. E. Shingles buoy N. E. by E. $\frac{3}{4}$ E. $1\frac{1}{2}$ miles.

The N. E. Shingles buoy is a can-buoy with red and white horizontal stripes, near the northeastern extremity of the shoal in 7 fathoms. It marks the south side of the entrance to the North channel, and from it Hurst high light-house bears N. E. by E. $\frac{1}{4}$ E. 0.8 mile, Warden Ledge buoy S. E. $\frac{1}{2}$ S. $\frac{1}{2}$ mile, and the Needles light-house S. W. $\frac{1}{4}$ W.

Bridge Reef extends upward of $\frac{3}{4}$ mile W. by S. from the Needles light-house. The three Needle Rocks in one lead along the backbone of this dangerous reef, which is very narrow toward the western end, and steep to on both sides. On the ebb tide its position is distinctly marked by great overfalls; in quiet, moderate weather by the ripple; and during southerly gales by a well-defined line of broken water. With much ground-swell, which always accompanies southerly winds, and even rises with an impending breeze from that quarter, the sea breaks with great violence for a considerable distance from the light-house.

Bridge Reef.

Vessels of great draught should not approach it nearer than to bring the south end of Hill-farm trees just within or south of Warden Point, E. $\frac{1}{2}$ N. The north end of the trees kept just within the point will lead close to a 19-foot rock; while to the eastward of this line the reef becomes more dangerous as the Needle Rocks are approached. Hill-farm trees open north of Hatherwood Point, E. by N., leads westward of all the shoal heads under 2 fathoms, but close to the 6-foot rock near the Goose; Pepper Rock open of Sun Corner, E. by S., leads 2 cable-lengths south of Bridge Reef; it also leads south of St. Anthony Rock, and a rock

awash, both of which lie eastward of the Needle Rocks in Scratchel Bay, and are dangerous for small vessels making too free with the shore. St. Anthony Rock lies a cable-length W. N. W. $\frac{1}{2}$ W. from Sun Corner, and dries at low-water springs; the rock awash is upward of a cable-length outside it on the same bearing. Two dangerous heads lie N. W. by N. about $\frac{1}{2}$ cable-length from the outer Needle Rock. The inner head dries at low-water springs, and is called the Goose; the outer lies a little to the northward, and has 6 feet water on it. Small vessels desiring to avoid the strength of the ebb tide by getting into Alum Bay, should give the Needles light-house a berth of at least 150 yards, for there are many dangerous sunken rocks for some distance outside it.

Five Rocks.

The Five Rocks is a small rocky patch with 3 feet water, S. W. of Hatherwood Point, and $1\frac{1}{2}$ cable-lengths off shore; but it is dangerous only to small vessels which anchor in Alum Bay, or turn to windward close in shore to avoid the tide. The north end of Hill-farm trees open of Hatherwood Point, E. by N., will lead westward of it; and the north end of the same trees kept just within Warden Point will lead outside the rocky ledges, which extend upward of a cable-length off Hatherwood Point.

Tinker Patches.

Between Hatherwood Point and Cliffs-end the bottom is nearly all foul, and names have been given to the most dangerous projecting parts. The Tinker Patches is a large field of rocks on the northeast side of the anchorage in Totland Bay, to which it affords shelter. The least water, 9 feet, is near the western limit of the shoal, about $\frac{1}{2}$ mile off shore, with the south end of Hill trees in line with Warden Point.

Warden Ledge.

Warden Ledge extends N. N. W. 4 cable-lengths from Warden Point, at which distance there is only 9 feet at low water, with deep water close to. About half its length dries at low water. A red can-buoy lies in $5\frac{1}{2}$ fathoms close to its outer edge, with Hurst low light-house N. by E. $\frac{1}{4}$ E., the flag-staff of Victoria fort just seen over the low part of Cliffs-end, E. N. E. $\frac{1}{2}$ E.; and Needles light-house S. W. by W. $\frac{1}{2}$ W.

How Ledge and Bank.

How Ledge projects upward of $\frac{1}{2}$ mile from the bottom of the bight between Warden Point and Cliffs-end, called Coldwell Bay. There is as little as 6 feet water on its outer

edge; and thence with a sweep to the northward the 2-fathom line of How Bank falls back toward Cliffs-end.

As shoal rocky ground extends all the way between the outer end of Warden Ledge and the off-lying rocks at Cliffs-end, vessels of even light draught should not approach the shore nearer than to have the whole of Victoria fort on Sconce Point open of Round Tower Point. A good berth should also be given to Cliffs-end Point, as detached heads lie upward of a cable-length outside it; but thence to Sconce Point there are no outlying dangers.

Mineway Bank, a shoal patch of foul ground, with only 9 feet water, lies at the western entrance of the North Channel, between the Shingles and Hurst beach, about $\frac{1}{3}$ mile from the latter. The low light-house at Hurst nearly on with the south end of the trees at West Hill leads well to the southward; and Milford church seen between the two western houses of Milford, N. E. $\frac{1}{4}$ E., leads $\frac{1}{2}$ cable length to the westward of it. Mineway Bank.

North Head is a dangerous gravel knoll, with only 9 feet water, lying on the southern side of the North Channel, and narrowing the passage between it and the beach to $\frac{1}{3}$ mile. A vessel will be abreast it when Milford church bears N. $\frac{1}{4}$ E., and to the northward of it when the flag-staff at Sconce Point opens northward of the low light-house E. S. E. The extremities of Hurst and Sconce Points touching lead over it. North Head.

The Trap is a small spit of sand and gravel thrown up at Hurst Point by the strong eddy on the ebb tide; and though near the beach and steep-to, it is much in the way of vessels hugging the point to avoid the tide, and should, therefore, be given a fair berth. The Trap.

The anchorage in Alum Bay is only resorted to by yachts or small vessels, as there is much foul ground in it, and to avoid the tide they anchor close in shore. The best position is in 3 to $3\frac{1}{2}$ fathoms, with the junction of the red and white cliffs bearing about S. E., and Hatherwood low point and Cliffs-end in line, N. E. by E. $\frac{1}{2}$ E. Anchorage.

Totland Bay affords good shelter for vessels of moderate draught, particularly in easterly winds, being well protected by the Tinker Patches and Warden Ledge. The best anchorage is on the southern side of the bay, in $3\frac{1}{2}$ to 4 fathoms, sandy bottom, with the Needles Point and Hather-

wood Point in one, W. S. W.; and Nodes beacon over the west end of a small plantation at the bottom of the bay, S. $\frac{1}{4}$ E. Little or no ebb tide will be felt, and the flood is not strong enough to impair the security of the anchorage.

Magnetic variation.

The magnetic variation was $20^{\circ} 43'$ W. in the Needles Channel in 1870; decreasing at the rate of $7'$ annually.

Tides, Needles Channel.

It is high water, full and change, at the Needles at 9h. 46m.; springs rise $7\frac{1}{2}$ feet, neaps 5 feet. At Hurst the first high water is at 10h. 0m., the second at 12h. 0m., and low water at 3h. 40m.; springs rise $7\frac{1}{2}$ feet, neaps 6 feet. The flood or eastern stream makes at 3h. 40m., and the western stream at 10h. 0m.; their velocity over the Bridge, and in the Needles Channel, is 3 to 4 knots, between Hurst Point and the island shore $5\frac{1}{2}$ knots, and to the southward of the Bridge about 2 knots.

There is no in-draught into the Needles Channel on the flood, unless within about $1\frac{1}{2}$ cable-lengths of the light-house. The direction of the flood stream $\frac{1}{4}$ mile outside the light-house, and off Sun Corner, is S. E. $\frac{1}{2}$ E. about $1\frac{1}{2}$ knots. The ebb sets smartly across the Bridge about W. S. W., but gradually turns to the westward about half a mile from the reef, where its direction, which is the fair tide, is W. N. W. $\frac{1}{2}$ W., with a rate of $1\frac{1}{2}$ knots at springs. The stream turns nearly with the tide on shore at Hurst.

At the entrance of the channel, or between the S. W. buoy and the west end of the Bridge, the flood sets directly through the fairway, S. E. by E. $\frac{1}{4}$ E. toward the Needles lighthouse, but turns rather abruptly to the eastward about half-way between the southwest prong of the Shingles and the light-house, with a velocity of at least 3 knots at springs. It then continues to run along the island shore sweeping the bays, and over the shoals between Hatherwood and Sconce Points, at the rate of about 4 knots at springs, and nearly 3 knots at neaps. In mid-channel the flood sets fairly up between the points, with about the same strength. Near the Needles Channel edge of the Shingles, the flood sets to the eastward, right off the bank, for some distance before it bends to the northeastward. On this side of the channel its velocity is not great until it begins to feel the influence of the North Channel tide, when it acquires a rate of about $5\frac{1}{2}$ knots at springs, and 3 knots at neaps.

It will be seen that on the flood all danger lies on the

island side of the Needles Channel; indeed, it would be a matter of some difficulty to ground on the Shingles with a flowing tide.

The ebb splits about one-third of the way across between Hurst Point and Cliffs-end, one part running through the North Channel, and the other setting obliquely across the Needles Channel and over the Shingles, between the N. E. and Elbow buoys, with considerable velocity. In any position in the Needles Channel to the northward of the Warden Ledge buoy, the in-draught of the North Channel is powerfully felt, and great prudence is necessary not to get within its influence in light and baffling winds; for a vessel would probably be swept through the North Channel by it if on the Hurst side, and if on the island side she would be carried on the Shingles unless quick in anchoring. In light winds, with an ebb tide, therefore, keep well over on the island shore until abreast the Warden buoy, and thence the tide will set clear of the Shingles. Anywhere between Warden Ledge and Sconce Point a vessel will be more or less affected by the influence of the North Channel tide, and, therefore, might be carried through that passage, or so far to the northward as to be in danger of the Shingles. In mid-channel between Warden Ledge buoy and Hatherwood Point, the tide takes the course of the deep water. Abreast Hatherwood Point the influence of the outset at the entrance begins to be felt, and in calm weather would take a vessel safely through the channel between the tail of the Shingles and the Bridge, with a velocity of nearly four knots at springs.

There is no appreciable tide on the ebb in the various little bays on the island side, as it is deflected by the shoals; but beyond Alum Bay small vessels should not approach the Needle Rocks or the north side of Bridge Reef very closely, as the tide runs over it with considerable strength.

The flood-tide sets fairly through the North Channel, taking the course of the deep water, and runs with great rapidity from the elbow in Hurst beach, called Put-off Point, to its confluence with the Needles Channel flood, which is about 2 cable-lengths south of the point, and distinctly shows itself by a turbulent broken sea. At the western entrance its rate is from 3 to $3\frac{1}{2}$ knots at springs, and 2 knots at neaps; but from Put-off Point to the eastward it increases

Tides, North
Channel.

to a race, with a velocity at springs of at least 5 knots. A strong eddy which runs between the meeting of the tides and the point must be carefully avoided, for in it a vessel would be totally unmanageable.

The portion of the ebb which runs through the North Channel sweeps gradually but with considerable force round Hurst Point, causing a strong counter-tide in-shore. Like the flood, it follows the direction of the channel and sweeps round Christchurch Bay, gradually diminishing in strength. Its rate off Hurst Point is about 4 knots at springs, and 3 knots at neaps; and to the westward of Put-off Point from $1\frac{1}{2}$ to $2\frac{1}{2}$ knots. The stream turns to the westward a little before high water by the shore, and runs about six hours each way.

At the back of the Shingles both flood and ebb are regular, and have no great strength between the S. W. buoy and the North Channel. The direction of the flood is from E. by S. at the first quarter, to S. E. $\frac{1}{2}$ E. at half tide, setting across the Shingles. A mile from the edge of the bank its greatest rate at springs is about $2\frac{1}{2}$ knots, but it runs with much greater rapidity over the bank. The direction of the ebb is from N. W. by W. to W. by N., running from 1 to $1\frac{1}{2}$ knots. The turn of the stream is uncertain, but it has been found to run to the eastward from about one hour before the time of low water by the shore.

Directions.

A stranger when nearing the entrance of the Needles Channel should keep Nodes beacon well open to southward of the Needles light-house until the leading marks are visible.

Approaching from the westward, steer in with Nodes beacon in line with the junction of the red and white cliffs in Alum Bay, E. S. E. $\frac{1}{4}$ E., or the Needles light-house, E. S. E., until the south end of the trees at Hill farm is just within or south of Warden Point, E. $\frac{1}{2}$ N. Keep this latter mark on, to pass between Bridge Reef and the S. W. prong of the Shingles, until Hurst light-houses are in line, N. E. by E. $\frac{1}{2}$ E., when steer for them. As the Elbow buoy of the Shingles is approached keep the high light-house its own breadth open southward of the low one, bearing in mind that the Needles light-house must not be brought westward of S. W. by W. until the whole of Victoria fort on Sconce Point is open of Round Tower Point, to clear the Tinker,

Warden, and How ledges and banks. When Warden Ledge buoy is passed, borrow a little toward the island shore to avoid the eddies off Hurst Point. After passing Cliffs-end act according to circumstances, recollecting that the flood sets strongly for more than half the distance to Sconce Point, when it strikes across for the Lymington shore toward Jack-in-the-basket beacon; and that from Hurst road the ebb runs for Nodes beacon until the North Channel opens out, when it turns rather suddenly to the westward through that channel. There is a strong eddy on the flood close in shore on the island side.

Approaching from the southward with a fair wind, Hurst high light-house bearing E. N. E. will lead toward the S. W. Shingles buoy, and when the south end of the trees at Hill farm is just south of Warden Point proceed as above directed.

If intending to cross the Bridge steer in with Hurst light-houses in line, N. E. by E. $\frac{1}{2}$ E., and when well within the reef, or when the Needles light-house bears S. E. $\frac{1}{2}$ E., or is in one with Sun Corner, edge a little to the northward if the tide is flowing, to avoid being set too close to the island shore.

No vessel should attempt to beat through the Needles Channel, except under able management; and in doing so it must be borne in mind that on the flood the Shingles side is the safe one; that in standing to the northward Sun Corner must be kept well open of the Needles light-house, for in line they are a scraping mark for the southwest prong of the Shingles; and that the Bridge must not be crossed farther eastward than to have the north end of the trees at Hill farm in line with Warden Point.

Working out on the ebb, when standing to the westward in the vicinity of the Elbow buoy, Hurst high light-house should not be brought within its own apparent breadth of the low light-house, as the ebb sets strongly over the Shingles. Perhaps it would be advisable, when abreast Hurst beach, to throw the vessel's head toward the island, and drop her out with the tide.

The Needles Channel may be considered safe at night with clear weather, a fair wind, and moderate attention, recollecting that in entering from the westward the southern limit of the Needles bright light, bearing E., passes about

At night.

1½ miles south of Durlston Head; and that its northern limit, E. S. E., passes about 2 cable-lengths south of the Dolphin Bank and the S. W. buoy of the Shingles.

A sailing-vessel approaching from the westward, with the wind to the southward of W., and having crossed the northern limit of the red light, should steer in with the bright light bearing E. by S. until the high light at Hurst bears E. N. E., when the S. W. buoy of the Shingles will be nearly in the same line, and the low light will be seen a little to the southward of the high light. Keep the Hurst lights in this position until the Needles bright light bears E. S. E. ½ E., or before it changes to red, when edge quickly to the eastward to bring the Hurst lights in line, N. E. by E. ½ E., then steer about E. N. E., and proceed up the channel with the high light a little open southward of the low light, which, as already observed, is necessary in passing the Elbow buoy. In nearing Hurst take care to avoid the eddy off the point on the flood, and the in-draught of the North Channel on the ebb.

With the wind to the northward of W. a vessel may steer E. S. E. near the northern edge of the bright light until the high light at Hurst bears E. N. E., then edge to the eastward to get the Hurst lights in line and proceed as before. So long as the depths are not less than 10 fathoms at low water, the vessel will be well to the southward of the Dolphin Bank; but soon after the Hurst lights are brought to the northward of E. N. E. ½ E. they will decrease from 9 to 7 fathoms, which will be a warning of a near approach to the entrance. When in the fairway the soundings may decrease to less than 5 fathoms, but when they deepen to 10 fathoms the vessel is well within the tail of the Shingles and Bridge Reef.

If approaching from the southward steer in under easy sail with Hurst high light E. N. E., and the first cast under 10 fathoms will be a warning that the S. W. buoy is about a mile distant. Keep the light on this bearing, with soundings gradually decreasing to 6 or 5 fathoms until the Needles bright light bears E. S. E. ½ E., when edge quickly to the eastward to get the Hurst lights in line N. E. by E. ½ E., and proceed as before.

Proceeding out of the Needles Channel with the ebb, when abreast Hurst, keep the bright ray of the Needles

light well in sight, S. W. by W. $\frac{1}{4}$ W., to avoid the in-draught of the North Channel and the ledges on the island side. When past Warden Ledge the Needles red light may be opened a little, taking care to keep the high light at Hurst open southward of the low light until well below the Elbow buoy, or until the Needles light bears S. S. W., when the Hurst lights may be brought in line. When the Needles light changes from red to bright the vessel will be clear of the Shingles, and if of great draught should keep to the westward to avoid the Bridge.

In working out the ray of bright light from the Needles light-house will be found a useful guide for going about when standing to the eastward in the vicinity of Warden Ledge; but as soon as the red light opens in making the western board take care not to bring the Hurst lights in one—they will be found to close rapidly on the ebb—in order to avoid the strong in-draught of the North Channel, as well as dangerous proximity to the Shingles.

The North Channel, between the Shingles and Hurst North Channel. beach, may be sometimes taken with advantage, especially by steam-vessels of moderate size. It is quite safe for any vessel which does not draw more than 15 feet, provided the wind is free enough to allow her to shape a course by the marks. Only vessels of light draught, with local knowledge, should attempt to beat through, bearing in mind that the rise and fall is only from 5 to 7 feet, and that the tide stands at the high level for two or three hours.

With the wind from N. or N. E. on the ebb a vessel may work to the northward with great advantage at the back of the Shingles, taking care in standing eastward not to bring Milford church to the northward of N. E. $\frac{1}{4}$ E. until Hurst Point is seen coming on with Sconce Point, when it will be quite safe to keep to the eastward, gradually bringing the low light-house a little to the northward of the south end of West-hill trees, S. E. by E. $\frac{3}{4}$ E., which will lead through the North Channel in not less than 17 feet at low water. With this mark on she may run pretty close to the beach, which is steep-to, altering the course when necessary to keep about half way between the N. E. buoy of the Shingles and Hurst Point; with the flood she will be carried quickly past the point, but care should be taken to keep outside the eddy off Trap Spit.

It would be useless to attempt the North Channel against the ebb unless with steam or a fresh leading wind ; if, however, it should be deemed practicable, take care in keeping close to the beach to cheat the tide not to run on the Trap.

Tides in the Solent.

The western stream through Spithead has great influence over the rise and fall of tide in the harbors of the Solent. At 10h., full and change, the tide slacks at the Needles, at which time it is also high water at Yarmouth. The tide then falls there from four to six inches, but in half an hour, or at 10h. 30m., the western stream has acquired strength in the Solent, by which the water is again accumulated, and rises to its former level, making a second high water about noon. A uniform fall or ebb then takes place until low water at 3h. 30m., about the time that the stream slacks near the shore. Spring tides fall about $2\frac{1}{2}$ feet lower and rise about $2\frac{1}{2}$ feet higher at Lepe and Cowes than at Yarmouth and Hurst. At the Solent Banks the stream turns to the westward at 9h. 30m., and to the eastward at 4h., and the greatest velocity of both streams is $3\frac{1}{2}$ to 4 knots. To the westward of the Bramble Bank, in the fairway, the flood makes about $1\frac{3}{4}$ and the ebb $1\frac{1}{2}$ hours later than at Spithead.

Directions through Solent to Spithead.

There are no dangers in the fairway of the Solent except the Solent Banks, and as no clearing-marks intelligible to a stranger can be given, vessels of great draught had better pass between them and the island shore. To avoid the long mud-flats which extend off the north shore, do not bring the high light house at Hurst to the southward of W. $\frac{1}{4}$ S. until abreast Egypt Point, or come into less than 6 or 7 fathoms. Hill-farm trees on with the east end of the north side of Yarmouth, and well open northward of the Mount trees at the east end of Yarmouth, W. $\frac{3}{4}$ S., lead in the fairway from off Hampstead Point to Egypt Point. A safe rule for working to windward along the southern shore from Hampstead Point to Egypt Point is to keep a good half mile off shore, and not go into less than 8 or 7 fathoms water. Egypt Point is bold on its northern face, and may be passed at a distance of $1\frac{1}{2}$ cable-lengths.

Vessels proceeding from the Solent toward Spithead usually go between the Ryde Middle Shoal and the Mother Banks. If intending to take this channel, having passed through Cowes Road, and between the red buoy off Old Castle Point and the west buoy of the Middle, steer so as

to bring Egypt Point just open of Old Castle Point, W. N. W. nearly, and these marks on astern will lead to the anchorage at Spithead. There is an equally good channel between the Ryde Middle and the Bramble Bank, the leading mark through being the tower or flag-staff of Southsea castle well open north of Fort Monkton, E. S. E. When the east buoy of the Middle bears S., steer S. E. $\frac{1}{2}$ E. for Spithead. The former mark leads to the anchorage in Stokes Bay, which is often resorted to by small vessels in strong northerly winds; vessels of great draught will pass outside the banks in this bay by keeping Calshot Castle open south of Calshot light-vessel.

If proceeding westward from the anchorage at Spithead, and intending to go north of the Ryde Middle, steer about N. W. into Stokes Bay until the tower or flag-staff of Southsea castle appears well open northward of Fort Monkton, E. S. E.; and with this mark on, proceed between the Middle and Bramble Bank until abreast Egypt Point, when the course to Hurst is W., $9\frac{1}{2}$ miles. To go south of the Middle, steer to the westward until Egypt Point is just open of Old Castle Point, W. N. W. nearly, taking care when nearing the east buoy of the Middle not to bring Egypt Point too much open of Old Castle Point, for fear of getting too near the shoal. When the west buoy of the Middle bears about N. N. W. steer N. W., or more northerly, to avoid the ledge off Old Castle Point, till Egypt Point bears W. $\frac{3}{4}$ N., and then steer W. N. W. till abreast it.

A vessel of great draught working to windward to the northward of the Ryde Middle may stand toward the Sturbridge Shoal and Gilkicker Point into 10 fathoms at low water, toward the Mother Bank into 7 fathoms, in Stokes Bay to 9 or 8 fathoms, toward Ryde Middle to 7 fathoms, toward the shore to the same depth, and not nearer the Bramble Bank than 9 fathoms, nor Old Castle and Egypt Points than 8 fathoms. When working to the southward of the Middle, stand no nearer the Mother and Middle Banks than the depth of 7 fathoms. Between Egypt Point and Yarmouth the island shore may be approached to the depth of 8 or 7 fathoms, and the main to 7 or 6 fathoms.

Bound up the Solent at night, the light shown in the eastern face of the high light-house at Hurst kept bearing W. will lead south of the Solent Banks and up to Egypt

Point. When Calshot light bears N. E. the vessel will be a little westward of Cowes Road, in which she may safely anchor for the night, or proceed to Spithead by steering S. E. by E. to pass between the Ryde Middle and the Mother Bank, until the light on Ryde pier bears S. S. E.; the vessel will then be eastward of the east buoy of the Middle, and it will be necessary to steer E. S. E. to give the Sturbridge Shoal a good berth and reach the anchorage.

Hurst Road.

Hurst Road on the northeast side of Hurst Point affords bad anchorage in easterly and southeasterly winds, and is seldom used in consequence of the uncertain eddies which render it almost impossible to keep a clear anchor. Small vessels sometimes bring up, and a few of them can lie snugly out of the tide in a good depth of water over a clean bottom, at a moderate distance from the beach, but not nearer the mud than to have the middle Needle Rock on with the eastern side of Hurst Castle, or just over the point.

Telegraph.

An electric submarine cable is fixed about 400 yards westward of the west wing of Victoria fort on Sconce Point, extending thence in a direct line across the Solent to the central towers of Hurst Castle, and vessels are cautioned against anchoring near it, lest by doing so they damage the cable or lose their anchors. There is a telegraph station near Hurst Castle, from which the arrival and departure of vessels off the Needles can be reported at places in Great Britain or on the continent. Vessels can also have their numbers reported, or messages forwarded, as they pass up the Solent.

Yarmouth Road.

The town of Yarmouth, at the mouth of the little river Yar, has a convenient port for small vessels, with an excellent quay, and valuable shelter is afforded by means of a substantial breakwater. The river, which almost insulates the western part of the Isle of Wight, is navigable as far as the Freshwater Mills. The road affords shelter from all but easterly winds, especially those between N. E. and E. S. E., to which it is much exposed. Vessels of moderate draught should anchor about $\frac{1}{2}$ mile from the shore in 7 fathoms, good holding-ground, and little tide, with the mast on Sconce Point bearing W. by N., and Yarmouth church and castle masts in line, S. $\frac{1}{4}$ W., but those of great draught should take up an outer berth in 8 or 9 fathoms, where the

tide runs E. S. E. and W. N. W. about $2\frac{1}{2}$ or 3 knots at springs.

Two fixed lights are exhibited at Yarmouth, the outer one, green, from a lamp-post on the quay near the castle-wall, and the inner one, bright, from the corner of a house. They are 30 yards apart, each 12 feet above high water, and when in one, S. S. W., lead into the harbor in 14 feet at high-water springs. Lights.

When running for these roads from the westward, avoid a dangerous ledge called Black Rock about $\frac{1}{4}$ mile westward of the anchorage. The greater part of it dries at low-water springs, and as foul ground extends some distance outside it, do not approach nearer than to have the conspicuous high tower of a house called the Refuge open to the northward of the old castle at Yarmouth, S. E. $\frac{1}{4}$ S. A red can-buoy lies in $10\frac{1}{2}$ fathoms water, a little outside and to the northward of the rock, with the west end of Tapnel farm open of east end of Sand house at Yarmouth bridge, S. E. by E. $\frac{1}{2}$ E.; the jetty at Sconce Point W. $\frac{1}{4}$ S.; Lymington Spit buoy N. N. E. $\frac{3}{4}$ E. $1\frac{1}{8}$ miles; and Hampstead Ledge buoy E. about $3\frac{1}{8}$ miles. Black Rock.

A short distance outside Black Rock there is a deep hole, which must be carefully avoided by boats when it is blowing hard during a weather tide, as it occasions a great over-fall, and sometimes the sea is alarming. It is known to the local fishermen as the Fiddler's Race.

It is high water at Yarmouth, full and change, at 10h., and again at 12h., and low water at 3h. 30m.; springs rise 7 feet, neaps 6 feet. Tides.

Small vessels will find better anchorage and less tide in Lymington Road than off Yarmouth. Anchor in 5 fathoms, over sand and mud, with the large ball-beacon called Jack-in-the-basket in line with Lymington church, N. N. W., and Hill trees on with Norton house, S. W. $\frac{1}{2}$ W. To avoid the Lymington Banks at night, keep the Needles light shut in with Cliffs-end fort. Lymington
Road and River.

The western side of the entrance to Lymington River is marked by a checkered red and white can-buoy in 12 feet water, on a spit which projects a considerable distance from the mud-banks on the north side of the Solent. The Jack-in-the-basket beacon is also on the western side of the river-channel. No stranger should attempt the entrance without

a pilot. Entering the river at high water, keep Jack-in-the-basket beacon in line with Lymington church, N. N. W., until near the checkered red and white buoy, which may be passed pretty close, as well as the perches, all of which should be left on the port hand. Abreast the town there is 14 feet at high-water springs and 11 feet at neaps.

Tides.

In Lymington River it is high water, full and change, at 10h. 25m., again at 12h. 15m., and low water at 4h.; springs rise 8 feet, neaps 6 feet.

Solent Banks.

The Solent Banks are accumulations of loose shingle in the fairway of the Solent, about half way from Sconce Point to Egypt Point, near the spot where the first of the flood through the Needles Channel meets the last of the ebb. They extend upward of $\frac{3}{4}$ mile E. by N. and W. by S., with a width of 2 cable-lengths. From the shoalest head, which has 22 feet water, the western edge of Hill-farm trees is in line with Yarmouth sand-house, W. S. W. $\frac{3}{4}$ W., and the coast-guard shed at Fish-house Point is in line with the large chalk-pit on the distant down, S. by E. $\frac{3}{4}$ E. The low light-house at Hurst bearing W. will lead to the southward of these shoals.

South Shore of the Solent; Hampstead Ledge.

Hampstead Ledge extends 2 cable-lengths off shore near Hampstead Point, 3 miles eastward of Yarmouth. There is a red can-buoy in 5 fathoms on its northeast end, $\frac{1}{4}$ mile from shore, with the northeast end of the trees on Hampstead Point in line with the northeast end of Saltern Park, S. E. by E.; Egypt Point with Gurnet buoy nearly in line, E. $\frac{1}{2}$ N.; Pitts Deep coast-guard houses N. by W. $\frac{1}{4}$ W.; and Salt Mead buoy E.

Newtown Gravel Banks.

Eastward of Newtown River the Newtown Gravel Banks extend in some places about $\frac{1}{2}$ mile off shore, and are much in the way of small vessels when hugging the shore to keep out of the tide.

Salt Mead Ledge.

Salt Mead Ledge is a $2\frac{1}{2}$ -fathom patch of foul ground extending nearly $\frac{1}{2}$ mile off the shore of Thorness Wood. On its northeast edge is a red can-buoy in 5 fathoms, with Egypt Point bearing E. $\frac{3}{4}$ N.; Luttrell tower a little within Stansore Point, N. E. $\frac{1}{2}$ E.; Pitts Deep coast-guard houses N. W. $\frac{1}{4}$ W.; Lepe Middle buoy N. E. $1\frac{9}{10}$ miles; and Gurnet Ledge buoy just open of Egypt Point, E. by N. 2 miles. The Mount trees at Yarmouth in one with Hill-farm trees,

W. $\frac{1}{2}$ S., clear both this ledge and the Newtown Gravel Banks.

A series of rocky ledges lie off Gurnet Head, about $1\frac{1}{2}$ miles eastward of Egypt Point. About $\frac{3}{4}$ mile eastward of the head, and nearly parallel with the shore, are the Gurnet Ledges, the eastern extremity of which is marked by a red can-buoy, moored 2 cable-lengths off shore, in 8 fathoms, with Gurnet Bay coast-guard houses S. E. $\frac{1}{2}$ E.; Lepe Middle buoy N. W. by N. $1\frac{1}{10}$ miles; and West Bramble buoy E. N. E. $2\frac{1}{2}$ miles. Egypt house open north of the old lime-kiln, E. $\frac{1}{4}$ N., leads outside the buoy, but will not clear the rocks to the eastward of it in Gurnet Bay.

On the northern shore of the Solent the Lepe Middle Shoal projects about a mile from the shore off the entrance of Beaulieu River. It lies well to the northward of the fairway course to and from Spithead, but being the turning point into Southampton water it is marked by a conical buoy with red and white vertical stripes, in 4 fathoms, with the inner beacon at Lepe its apparent width east of the outer beacon, N. by E. $\frac{3}{4}$ E.; Old Castle bathing-house open of Egypt Point S. E. by E. $\frac{1}{2}$ E.; and West Bramble buoy E. $2\frac{1}{2}$ miles. Luttrell tower, a conspicuous building between Stansore Point and Calshot Castle, kept open east of Stansore Point, N. E. $\frac{1}{4}$ E., leads eastward of the buoy and over the eastern tail of the shoal in 4 fathoms; and Hill Head coast-guard houses midway between the large chalk-pit and Nelson's monument on Portsdown hill, E. $\frac{3}{4}$ N., leads south of the buoy and over the tail of the shoal in the same depth.

The entrance of Beaulieu River is about $\frac{3}{4}$ mile westward of Stansore Point, and is obstructed by a mud-bar, on which there is but 2 feet water at low-water springs, but there are depths of 4 and 5 fathoms inside. The two red beacons on shore, close to the westward of the coast-guard buildings, in one, N. by E. $\frac{1}{4}$ E., lead over the bar in the deepest water; after which the channel is marked by perches. Springs rise $11\frac{1}{2}$ feet at the entrance, and neaps $9\frac{1}{2}$ feet. At Buckler's Hard, 4 miles up the river, springs rise 10 feet.

Prince Consort Shoal, composed of gravel and shells, is about a cable-length in extent, with 22 feet on its shoalest part, and lies E. N. E. $\frac{1}{4}$ E. $3\frac{1}{2}$ cable-lengths from the Club-house on West Cowes Point. A red can-buoy lies in 4 fathoms about 33 yards to the northward of the 22-feet

patch, with Old Castle Point S. E. nearly $\frac{3}{4}$ mile; the Club-house flag-staff W. S. W. $\frac{1}{4}$ W. about 4 cable-lengths; and West Middle buoy E. $\frac{3}{4}$ S. $1\frac{1}{2}$ miles.

To pass northward of this shoal, keep Ryde pier open of Old Castle Point.

Cowes.

Three-quarters of a mile eastward of Egypt Point is Cowes Road, and the entrance of Cowes Harbor, which is the principal port of the Isle of Wight, and the station of the Royal Yacht Squadron. Cowes Road is a safe anchorage, much frequented by yachts and merchant-vessels waiting orders. The usual anchorage is in 5 to 7 fathoms, with Cowes Castle W. S. W. $\frac{1}{2}$ W., and the sea-mark on Old Castle Point S. E. Pilots are always in attendance to conduct vessels into Cowes Harbor or Southampton water. Two black mooring-buoys are laid down between Prince Consort Shoal and Old Castle Point, for the use of H. Majesty's yachts.

Cowes Harbor has from 9 to 14 feet in it at low water, and 21 to 26 feet at high-water springs. A black buoy marks the spit at the eastern point of the entrance, and the channel, which is $\frac{1}{2}$ cable-length wide, is marked on its eastern side by two black buoys. The town of Cowes is on both banks of the river Medina, which is navigable for vessels of light draught to Newport, the capital of the island. Cowes is a place of great resort for bathing and yachting, and is noted for its ship-yards and dry-docks. The largest dock, in which several 74-gun ships have been repaired, is 330 feet long, 56 feet wide between gates, and has 16 to $17\frac{1}{2}$ feet over sill at high-water springs. There is also a patent slip, capable of taking up a vessel of 500 tons.

Tides.

With spring tides there are two high waters on shore in Cowes Harbor. On full and change days the first high water is at 10h. 45m.; the tide then falls one or two inches, and again rises two or three inches, making a second high water at 11h. 45m.; it then falls until low water, which is at about 4h. During neaps there is only one high water. Springs rise $12\frac{1}{2}$ feet, neaps $9\frac{1}{2}$ feet.

In Cowes Road the eastern stream makes at 3h. 30m., and the western stream at 9h. 50m.; their velocity is 3 to $3\frac{1}{2}$ knots.

Bramble Bank.

Bramble Bank is a vast accumulation of sand and gravel which extends from the eastern shore nearly across the en-

trance to Southampton water; a small part near the western end has been heaped up into a knoll, which dries at low water.

The East Bramble buoy lies at its southeastern extremity in 19 feet water, with West Bramble buoy W. N. W. $\frac{1}{2}$ W. $2\frac{1}{2}$ miles; West Middle buoy W. S. W. $\frac{3}{4}$ W. $1\frac{3}{10}$ miles; and East Middle buoy S. by E. $\frac{3}{4}$ E. $1\frac{1}{2}$ miles; it is conical with red and white vertical stripes.

The West Bramble buoy is conical and checkered red and white, with a staff and cage; it lies in $4\frac{3}{4}$ fathoms, at the southwestern extremity of the shoal, with Lepe Middle buoy W. $2\frac{1}{2}$ miles, and Prince Consort buoy on the south side of the channel, S. $\frac{1}{4}$ W., five-sixths of a mile.

The Northwest Bramble buoy is a red can-buoy in 25 feet water, N. N. E. 4 cable-lengths from the West Bramble buoy.

The Hill Head buoy is conical and red; it is marked "Hill Head," and lies in three fathoms water on the north-east side of the Bramble Bank, in line between the East Bramble buoy and Calshot Castle, with the N. W. Bramble buoy W. $\frac{3}{4}$ S. $1\frac{4}{10}$ miles, and Calshot light-vessel N. N. W. $\frac{7}{10}$ mile.

Calshot Spit is an extensive shoal running off southward of Calshot Castle, which stands on the extremity of the long low shingly point at the western side of the entrance to Southampton water. A black refuge-buoy is moored in 4 fathoms on the southeastern spit of the shoal, S. $\frac{1}{2}$ E. 1 mile from the castle, and nearly $\frac{3}{4}$ mile W. by S. from Calshot light-vessel; there is also a black buoy on its eastern edge, nearly 4 cable-lengths S. S. E. $\frac{3}{4}$ E. from the castle.

Calshot Spit.

Thorn Knoll lies between Calshot Spit and the north side of the Bramble Bank, in the channel leading to Southampton water. It is upward of $\frac{1}{2}$ mile long, with $2\frac{1}{2}$ fathoms water, and its west end is marked by a can-buoy with red and white horizontal stripes, in $4\frac{1}{2}$ fathoms, N. W. by N. 3 cable-lengths from the N. W. Bramble buoy.

Thorn Knoll.

Calshot light-vessel, in $5\frac{3}{4}$ fathoms on the eastern side of the channel leading into Southampton water, S. E. $\frac{1}{4}$ S. $1\frac{1}{6}$ miles from Calshot Castle, exhibits at an elevation of 31 feet above the sea a bright light, revolving every minute, which should be visible in clear weather from a distance of 9 miles. The vessel is painted red, with the name "Calshot" on her

Calshot light-vessel.

sides, and carries a ball at the mast-head. A gong is sounded in foggy weather, and a gun fired if a vessel is seen standing into danger.

Southampton
water.

Southampton water forms one of the finest harbors in Great Britain, being quite landlocked, and its approaches are so protected that no sea of any consequence can rise. From Calshot Castle to the town of Southampton the deep-water space embraces a channel 5 miles long and $\frac{1}{2}$ mile wide, between banks of soft mud, which cover at high water.

For $3\frac{1}{2}$ miles of this distance the channel carries 5 to 9 fathoms at low water, but $1\frac{1}{2}$ miles below the town, in mid-channel between Hythe and Netley abbey, is Netley Shoal with only 2 fathoms on it; there is, however, a 4-fathom channel on its western side, and a 3-fathom channel on its eastern side; and thence to the bar, which has 2 fathoms on it, the depths are 4 to 5 fathoms. Above the bar, abreast the town, there is a narrow space about $\frac{1}{2}$ mile long, with 3 to $3\frac{1}{2}$ fathoms in it.

The edge of the mud-bank bordering the western side of Southampton water is marked by black buoys, and that on its eastern side by red buoys. That on the western side between Calshot and Hythe is steep-to, suddenly breaking down from a high bank to 7 and 8 fathoms water. On the eastern side, 2 miles within the light-vessel, is the entrance of the River Hamble, which is navigable for small vessels to Bursledon bridge, about 3 miles, where there is 6 feet at low water, and the rise of tide is nearly the same as at Calshot Point. A spit runs out nearly a mile from the north point of the entrance, and its extremity is marked by a red buoy; the village of Hamble is about $\frac{1}{2}$ mile above the point. The town of Southampton stands at the confluence of the rivers Teste and Itchen, and is the principal foreign packet-station of England. The docks are built on a large scale on the south side of the town, and comprise a tidal basin, the entrance to which is on the west side of the Itchen, a floating dock, and three dry-docks which open out of the basin. The tidal basin contains 16 acres, has an entrance 150 feet wide, and carries a depth of 31 feet at high-water springs, 27 feet at high-water neaps, and 18 feet at low-water springs. It is surrounded by extensive bonded warehouses, vaults, sheds, and cellars, and is supplied with numerous cranes, and a pair of shears tested with a weight of 100 tons. The

floating dock contains 10 acres, is 770 feet long, 550 feet wide, and 56 feet wide at entrance; with 30 feet water in it, 29 feet over sill at high-water springs, and 25 feet at high-water neaps. The eastern dry-dock is 475 feet long, 425 feet on blocks, and 80 feet wide between gates, with 26 feet over the blocks at high-water springs, and 24 feet at neaps. The western and middle docks are of less size. A timber pile-pier extends from the center of the town into 2 fathoms at low-water and 4 fathoms at high-water springs. The docks are surrounded by extensive quays, and ships can enter at all times. An extension of the London and South-western R. R. is carried into the docks, so that goods and passengers can be conveyed to London within three hours.

The width of the anchorage off the town is about $1\frac{1}{2}$ cable-lengths, which increases to $3\frac{1}{2}$ cable-lengths lower down, and the depth is from $2\frac{1}{2}$ to $3\frac{1}{2}$ fathoms at low water. The channel from the mouth of the Itchen to the entrance of the tidal basin is widened and deepened to 16 feet at low-water springs. The channel of the river Teste above Southampton is marked by buoys and booms.

On the end of the town pier are two fixed lights, 15 yards apart, which in line lead through the channel. Lights.

There are also two fixed lights on the dock pier-heads; the one on the northern pier is dark red, and that on the southern pier red; in one N. N. E. $\frac{3}{4}$ E. they lead up the Itchen, which is buoyed on both sides to the entrance of the docks.

At Calshot Castle it is high water, full and change, at 11h. 30m., and low water at 4h.; springs rise 13 feet, neaps $9\frac{1}{2}$ feet. Tides.

There is a double high water at Southampton, probably caused by the tide from Spithead, for so long as the latter runs strongly to the westward the water is kept up at Southampton, and there is but little fall until it begins to slack at Spithead; but when the tide makes to the eastward at Spithead the water falls rapidly at Southampton. The first high water on full and change days is at 10h. 30m., the second high water at 12h. 45m., and low water at 4h. 0m.; springs rise 13 feet, neaps $9\frac{1}{2}$ feet. At Marchwood magazine springs rise 12 feet, neaps $9\frac{1}{2}$ feet. At Redbridge it is high water 12 minutes later than at Southampton, and low water one hour sooner; springs rise $8\frac{1}{2}$ feet, neaps 6 feet.

After low water the tide rises pretty steadily for about $6\frac{1}{2}$ hours, which may be considered as the first or proper high water; it then ebbs about 9 inches in the course of an hour, at the end of which it begins to rise again, and in about $1\frac{1}{2}$ hours reaches its former level, and sometimes rises higher; this is called the second high water. The ebb continues $3\frac{1}{2}$ hours, and falls most rapidly 2 hours after the second high water, at which time the stream runs strongest in the fairway. At neaps, although the tide stands for a considerable time near high water, there is no observable difference in the level.

There is a marked difference in the set of the tide, and in the time of its turning on the opposite sides of the entrance of Southampton water. Near Hill Head on the eastern side the eastern stream makes at 2h. and the western stream at 9h. 15m., running rather more than 7 hours one way and 5 hours the other, as it does at Spithead; while on the opposite shore the time of turning is at 3h. 45m. and 10h. 30m. Near Calshot light-vessel the streams are rotary, and turn nearly at the same time as at Spithead. The Bramble Bank has considerable influence in diverting the tide and increasing its rate. During the last two hours of the ebb the stream splits near Calshot, one part running to the westward and the other to the eastward.

Directions.

The principal channel into Southampton water is on the north side of Bramble Bank, and has a depth of 5 to 10 fathoms, but its width is considerably reduced by Thorn Knoll, on which there is only $2\frac{1}{2}$ fathoms. There is also a channel across the eastern part of Bramble Bank which may be used by small vessels, and at high water by those drawing 22 or 23 feet.

To enter by the western channel, when between Lepe Middle Shoal and Egypt Point bring Calshot light-vessel to bear E. N. E., when it will be a little open south of the black refuge-buoy on Calshot Spit, and steer for it. After passing about 2 cable-lengths westward of the light-vessel a N. by W. $\frac{1}{2}$ W. course will lead up to Southampton, keeping in mid-channel and leaving the red buoys on the star-board hand, and the black buoys on the port hand.

To enter by the eastern channel pass 2 cable-lengths eastward of the East Bramble buoy, steering about N. W. $\frac{1}{2}$ N. for Hill Head buoy, which should be passed close-to on its

southern side, and when midway between it and Calshot Spit refuge-buoy shape a course to pass 2 cable-lengths westward of the light-vessel, and proceed as above.

At night the bright light in the high light-house at Hurst, kept bearing W., will lead in mid-channel up the Solent.

When Calshot light bears E. N. E. steer for it, maintaining this bearing with great precision in order to pass between Thorn Knoll and Calshot Spit. Calshot light S. by E. $\frac{1}{2}$ E. will lead up to Southampton, but as the tide is strong this navigation should not be attempted by a stranger at night without a pilot. The two lights on the Royal pier in one lead up to the pier end. The two red lights on the dock pier-heads in one, N. N. E. $\frac{3}{4}$ E., lead up the Itchen to the entrance of the docks.

On the eastern side of the entrance to Cowes Harbor is Old Castle Point. an extensive high bank of mud, called the Shrape Bank, which at Old Castle Point dries upward of $\frac{1}{2}$ cable length from the shore; and as the water is shoal for some distance outside this, a red can-buoy is moored in 3 fathoms, with the bathing-house on Old Castle Point S. W. about 2 cable-lengths; Prince Consort buoy, N. W. by W. 0.7 mile; and West Middle buoy E. by N. 0.6 mile. At a distance of 130 feet within the buoy the depth is only 2 fathoms.

Ryde Ryde Shoal. Middle Shoal. Middle is a long narrow bank of mud, gravel, and shells, lying in the fairway of the channel to Spithead. Its western extremity is nearly $\frac{3}{4}$ mile from the red buoy off Old Castle Point, and it extends S. E. by E. upward of 2 miles parallel with the edge of Mother Bank. The least water on it is 2 fathoms, about $\frac{3}{4}$ mile from its western end, and there is 6 fathoms near the shoal on either side. On the west end is a can-buoy, with red and white horizontal stripes, in 28 feet water close to the westward of a 15-foot patch, with Asheydown tower S. $\frac{1}{2}$ E.; West Cowes mill, W. S. W. $\frac{1}{4}$ W.; E. Middle buoy, S. E. by E. 2.7 miles, and Peel Bank buoy S. E. by S. 1.7 miles. On the southeast extremity is a conical buoy with red and white horizontal stripes, in 3 fathoms, with Southsea Castle just open of Gilkicker Point E. S. E. $\frac{3}{4}$ E., Asheydown tower in line with a clump of trees S. by W. $\frac{1}{4}$ W., N. E. Middle buoy N. E. by E. $\frac{1}{2}$ E. $\frac{1}{3}$ mile, Calshot light-vessel N. N. W. $\frac{1}{4}$ W. 3.8 miles. On the northeastern extremity there is a conical buoy with red and white horizontal stripes, surmounted by

a staff and triangle, in 20 feet, with Southsea Castle light-tower just shut in with N. W. angle of Gilkicker fort, E. S. E. $\frac{3}{4}$ E., and Wootton Point in line with Ashtake house S. W. by S.

Peel and Mother
Banks.

Peel and Mother Banks extend $4\frac{1}{2}$ miles S. E. by E. from Old Castle Point, and terminate to the eastward in an inner and outer spit. The Inner Spit lies between Sturbridge Shoal and Ryde Sand, and the eastern edge of the Outer Spit in three fathoms lies $\frac{3}{4}$ mile W. N. W. from the western extremity of Sturbridge Shoal, with Kickergill tower in line with the western edge of the large chalk-pit on Portsdown hill N. E. The depth on these banks varies from $1\frac{1}{2}$ to $2\frac{1}{2}$ fathoms at low water, with 5 fathoms on their outer edge, which abreast Wootton Creek is $1\frac{1}{2}$ miles off shore; and there is 7 to 10 fathoms between the outer and inner spits of the Mother Bank and Sturbridge Shoal. There is a red can-buoy on the northern edge of Peel Bank in 5 fathoms, abreast King's Quay Creek and about a mile off shore, with Asheydown tower in line with N. end of Wootton coast-guard S. $\frac{1}{2}$ W., and two church-spires at Ryde in line, S. E. by S.

Quarantine
ground.

The quarantine ground is to the N. N. W. of the town of Ryde, and its limits are marked by five buoys, the three outermost of which are a mile off shore. The deepest water is near the lazaretto, where there is 4 to 5 fathoms. Merchant-vessels in pratique generally anchor between the Outer and Inner Spits of the Mother Bank and the Sturbridge Shoal in 5 to 11 fathoms, over good ground sheltered from southerly winds, with Ryde bearing S. W. to S. S. W.

Sturbridge
Shoal.

Sturbridge Shoal lies mid-way between Ryde and Gilkicker Point, is $\frac{3}{4}$ mile long in a S. E. $\frac{1}{2}$ E. direction, and has 16 feet water over it. On its western end is a can-buoy with black and white horizontal stripes, in $3\frac{1}{2}$ fathoms, with Nelson monument on with W. end of Anglesea terrace N. N. E. $\frac{1}{2}$ E.; the flag-staff on the end of Ryde pier on with the white Belvidere, S. W.; and Calshot light-vessel N. W. by N. 5.9 miles. At the eastern end is a conical buoy with black and white horizontal stripes, in 19 feet, with the tall chimney at Haslar on with the center of Southwick fort on Portsdown hill, N. N. E. $\frac{3}{4}$ E.; the center of Spit fort on with the east end of S. Parade, E. N. E., and No-Man's-Land fort S. E. $1\frac{1}{2}$ miles.

The town of Ryde is $4\frac{1}{2}$ miles southeast of Old Castle Point. Two piers, 200 yards apart, extend out from it; the western, or new pier, is 800 yards long, 22 feet wide, and has 7 feet water at the pier-end at low-water springs. The east pier is 400 yards long, 30 feet wide, with $4\frac{1}{2}$ feet water at the pier-end. Five sets of screw moorings are laid down on each side of the east pier. On the shore between the piers is the entrance to a tidal basin, 220 feet long, 110 feet wide, with $8\frac{1}{2}$ feet water in it at high-water springs, and $5\frac{1}{2}$ feet at neaps. At the head of the tidal-basin is a floating basin, 250 feet long, 20 feet wide at entrance, with 8 feet over sill at high-water springs and 5 feet at neaps.

A fixed light is exhibited from a lamp-post on the end of the old pier at an elevation of 21 feet above high water, which should be visible in clear weather from a distance of about 6 miles.

It is high water at Ryde pier, full and change, at 11h. 20m., and low-water at 4h. 15m.; springs rise 13 feet, neaps 10 feet.

In Stokes Bay, about $\frac{1}{2}$ mile northward of Gilkicker Point, at the terminus of the Southwestern R. R. is a pier 600 feet long, at the end of which there is 6 feet at low-water springs.

Red lights are exhibited from lamp-posts on the east and west ends of the pier, and when a steamer is expected a central red light is also shown.

Two beacon-buoys, each bearing a staff and ball, are moored off the shore of Stokes Bay to indicate the direction of the measured mile for testing the speed of H. Majesty's ships. The eastern buoy lies in 13 fathoms, $\frac{1}{2}$ mile southward of Gilkicker Point, and the western buoy is in 10 fathoms, $\frac{3}{4}$ miles southward of Brown Down batteries. They lie S. E. and N. W. a cable-length from either end of the measured mile, the limits of which are shown by beacons on shore. As the course between the buoys is not more than $1\frac{1}{2}$ cable-lengths outside a bank in Stokes Bay, on which there is but $3\frac{3}{4}$ and 4 fathoms, vessels of great draught should not turn toward the shore of the buoy.

High and precipitous chalk cliffs extend from the Needles to the middle of the bight between the latter and Brook Point, called Freshwater Bay, where they become lower and $1\frac{1}{2}$ miles beyond merge into a shore of clay and sand. On the

Ryde.

Light

Tides.

Stokes Bay.

Lights.

Measured mile.

S. W. coast of
Isle of Wight.

highest part of the cliffs is Nodes beacon, 490 feet above high water. About 3 miles from the Needles is a small cove, at the head of which is a watering-place called Fresh-water Gate. On the west side of the cove is a small fort cut out of the chalk cliff.

To the eastward of Brook Point is a small cove and landing-place off the chine, near which is Brook Village. Steep clay cliffs of moderate and nearly equal height extend from Brook to beyond Atherfield Point, and there are several beautiful chines and villages, at the back of which are high and extensive downs. About $1\frac{1}{2}$ miles from St. Catherine Point the land begins to rise; and 1 mile westward of the point is Blackgang chine, between which and Atherfield Point is Chale Bay, the scene of many fatal wrecks.

The whole of this part of the coast is fronted by dangerous ledges, which in some places extend nearly a mile from the shore. The principal ones are Brook and Atherfield Ledges; but there are also sunken rocks, of which St. Andrew and Chale Rocks are farthest off shore. The land should be approached with great caution, especially in thick weather and during the flood.

Landing-places. There is a landing-place at Chilton chine, one on each side of Atherfield Point, and another at Puckaster Cove, about a mile eastward of St. Catherine Point.

Life-boats. Life-boats are stationed at Brook chine, and at Brightstone Grange or Brixton chine.

Tides. It is high water at Atherfield Point, full and change, at 10h. 20m., and low water at 3h. 40m.; springs rise $8\frac{1}{2}$ feet, neaps 7 feet. In Freshwater Bay, about 1 mile S. W. of Brook Point, and the same distance off Atherfield Point, the western stream makes at 10h. 25m., and runs at the rate of 1 knot; the eastern stream makes at 2h. 35m., running from 2 to $2\frac{3}{4}$ knots; both streams take the direction of the coast. About $4\frac{1}{2}$ miles W. by S. from St. Catherine Point the western stream makes at 11h. 0m., setting N. W. $\frac{3}{4}$ W., and the eastern stream at 5h. 0m., in the opposite direction, the rate of both streams being 2 to 4 knots.

Directions. Between the Needles and St. Catherine Point the shore must be approached with caution, especially on the flood, which sets directly toward the numerous ledges which border the coast, especially those off Brook and Atherfield

Points. The highest of the chalk cliffs on the east side of Freshwater Bay on with Brook Point, N. N. W., or a remarkable white road running over the down in line with Blackwood Point, will lead outside Ship and Atherfield Ledges, and St. Andrew and Chale Rocks. A safe mark for small vessels working up in-shore is to keep the three Needles open of Sun Corner, or the Priory church at Christchurch open of the Needles light-house, N. W. by N. With the Needles light-house only open of Sun Corner, a vessel would run on the Atherfield Ledges.

At night a vessel of great draught should on no account lose sight of the Needles light, which disappears when bearing N. W. $\frac{1}{2}$ N., or stand into less than 15 or 16 fathoms at low water. It is a good precaution to keep the Needles light N. W. by N. until St. Catherine light bears N. E., when it will be safe to haul to the eastward.

CHAPTER VI.

ST. CATHERINE POINT TO BEACHY HEAD.

St. Catherine
Point.

St. Catherine Point, the southern extremity of the Isle of Wight, is a low rounded point with a stone light-house on it, which is conspicuous from the offing. About a mile northward of the point is St. Catherine Hill, the highest part of the island, on the summit of which, 804 feet above high water, are the remains of the old light-house and an old tower.

Close to the westward of St. Catherine Point, between it and Rocken End, is a rocky ledge with 3 to 6 fathoms on it, extending more than $\frac{1}{2}$ mile from the coast, and close to the shore are the Jeremy and Shag Rocks. At $1\frac{1}{2}$ miles W. $\frac{1}{4}$ N. from the Point is a rocky patch of 9 fathoms, with deep water round it.

Light-house.

The light-house is an octagonal castellated stone building, 122 feet high, exhibiting at an elevation of 178 feet above high water a fixed bright light which should be visible in clear weather from a distance of 19 miles. During fogs Daboll's fog-horn is sounded for five seconds, with intervals of fifteen seconds between each blast.

Tides.

One mile W. by S. from St. Catherine Point the tidal streams set N. W. by N. and S. E. by S. 3 to 4 knots, and two-thirds of a mile S. S. W. from it W. by N. and E. by S. with the same velocity.

Nearly 5 miles S. S. E. of Dunnose, at full and change, the streams turn at 10h. 40m. and 4h. 30m., and set E. $\frac{1}{2}$ S. and W. by N., with a velocity of 4 to 5 knots at springs and 3 knots at neaps; but S. E. 2 miles from Dunnose, the flood sets E. by N., and the ebb W. by S., and both streams turn rather earlier. One mile S. E. of Dunnose the flood sets N. E. by E., or toward the Princessa Shoal.

The eastern stream, from about $2\frac{1}{2}$ miles off St. Catherine Point, is sucked into the deep bight between the Isle of Wight and the main, but not so as to overcome its onward course toward the Owers, which it leaves nearly 5 miles to the northward. The inner stream closely follows the coast

until it reaches Bembridge Point, where, about a mile northeast of the Nab, it unites with the stream through Spithead, and they set toward Selsea Bill, into Bracklesham Bay, through the Looe and over the shoals at the rate of 2 to 3 knots, according to the distance off shore.

The western stream, near high water in Portsmouth Harbor, divides near the Nab, one part running through Spithead, the other over the Princessa Shoal and round Dunnose to the westward, until half ebb by the shore. At this period the tide has slacked at Spithead, and the rapid discharge of the last half of the ebb from Southampton water and Portsmouth Harbor produces such an increased velocity in the back-water as to turn or beat back from its course the stream at Spithead, converting the western into an eastern stream, which near the Nab meets the regular Channel ebb, and with it sweeps round to the southward of the Isle of Wight. Thus the ebb, for the last half of its duration, runs in opposite directions on the two sides of the eastern half of the island.

In bad weather give St. Catherine Point a good berth, to avoid the race and overfalls near it. The overfalls off St. Catherine Point and Dunnose are partly caused by the various sudden transitions from deep to shoal water in that neighborhood; but they are not dangerous, except in bad weather, when no open boats should attempt to pass through either. The race off St. Catherine Point varies in proportion as the wind is with or against the tide. In gales from the westward, and during spring tides, the sea breaks to the southeast of the point as violently as in the race of Portland. After rounding St. Catherine Point the seaman must be on his guard at night against the in-draught on the flood, which will be found more or less when navigating between the Isle of Wight and the Owers.

Directions: St.
Catherine Point
to Beachy Head.

The course and distance from about 4 miles south of St. Catherine Point to a similar position off Beachy Head is E. by S. 59 miles. By pursuing this route, a vessel will pass about 4 miles southward of the Owers light-vessel, and will not be materially affected by the in-draught between the Isle of Wight and the Owers on either tide. After passing St. Catherine Point, in thick weather, the shore should not be approached within the depth of 20 fathoms to pass well outside the Owers and preserve the fair channel tide.

The soundings between the Isle of Wight and Cherbourg are irregular. The general quality of the bottom to the southward of the fairway is coarse, loose, or rocky, and the stones are generally covered with reddish incrustations. Within the distance of 15 miles from the coast of Hampshire and Sussex the soundings become finer, being chiefly sand mixed with fine gravel, which continues as far eastward as Beachy Head.

The Owers light-vessel, when seen, will be a good guide for passing south of the Owers, or avoiding them when working to windward. A vessel will be westward of the Boulder Bank when the west end of Medmery barn is in line with the spire of Chichester Church, N. E. by N.; abreast of the Middle Owers when Pagham Church comes on with Rooks Hill, N. N. E.; and eastward of the Outer Owers and East Bank, when Bersted Church is in one with Goodwood, N. by E. $\frac{1}{2}$ E. In clear weather the red-clay cliff in Sandown Bay, Isle of Wight, open south of Culver cliff, though distant, is a good mark, and will lead $1\frac{1}{2}$ miles south of Boulder Bank and $\frac{3}{4}$ mile south of the Outer Owers.

At night the bearing of the Owers light and careful attention to the lead are the best safeguards when approaching these shoals. Steering to the eastward from Spithead, the Nab lights kept on a N. W. $\frac{1}{2}$ N. bearing astern will lead about $2\frac{1}{2}$ miles southwest of the Boulder Bank; but if these lights are lost sight of before the Owers light is seen, take care to allow for the eastern stream, if it is running, as it will be setting strongly abeam toward those dangers, especially after southwesterly gales. When the Owers light is sighted a course may be shaped to pass to the southward of it, but it should on no account be brought to bear more southerly than S. E. by E.

When working to windward between Beachy Head and the Owers, do not stand into less than 10 fathoms, or bring the Owers light to the southward of S. W. $\frac{1}{2}$ S. After passing any convenient distance to the southward of the light, the shoals will be cleared by not bringing it to the southward of S. E. by E.; but this is a close mark for a large vessel, and it will be prudent not to stand into less than 10 fathoms until the Nab lights are seen, when there can be no danger so long as they are not brought to the westward

of N. W. $\frac{1}{2}$ W. The depth of 10 fathoms is also a valuable guide for vessels between the Owers and Dunnose, for by keeping outside it they may be assured of being clear of all danger as long as the Nab lights are to the northward of N. E. by N., after which St. Catherine light should be kept in sight. Near the western end of Boulder Bank, a vessel steering for the Nab during the western stream will have it about two points abaft the beam; and as it runs strongly, particularly at springs, some allowance must be made, especially with a scant wind.

As the lead should invariably be kept going, and great attention be paid to the soundings, certain intimation will be had when the rocky banks to the southward of the Owers are crossed, and the first deep cast afterward in standing in must be the seaman's warning of his approach to the dangers. Attention is drawn to the important fact, particularly in thick weather, that, failing to obtain a deep-water cast, by which is understood over $9\frac{1}{2}$ or 10 fathoms, the seaman may be tolerably certain that he is westward of the Boulder Bank, and therefore great caution is requisite not to get embayed by standing in too far.

A low cliff extends along the shore between St. Catherine Point and Dunnose, and at its back are large masses of rock called the Undercliff, which is again backed by a wall of precipitous rock, nearly 500 feet above the sea, with downs rising still higher behind. Steep-hill Castle, with the villas and church at Ventnor, are conspicuous objects on this part of the coast, which may be approached to $\frac{1}{2}$ mile, as the rocks bordering it do not extend off above half that distance. St. Catherine Deep, with depths of 37 and 39 fathoms, rocky bottom, extends parallel with and about a mile off the shore, abreast the Undercliff. It is several miles long, and from half a mile to a mile wide, with depths of 11 and 12 fathoms, rocky bottom, on either side. Outside of its eastern end, upward of four miles S. E. $\frac{1}{2}$ S from Dunnose, is a rocky patch of 10 fathoms, with 25 to 35 fathoms between it and the land.

Above Dunnose, St. Boniface Down rises 770 feet above high water, and thence the land declines toward Culver Cliff, the eastern end of which, being of chalk, may be easily recognized from the marked contrast between it and the land in its vicinity. Between Dunnose and Culver Cliff is Sandown Bay.

Sandown Bay, in which are the villages of Shanklin and Sandown. The water is shallow for some distance off the shore of the bay; but the lead will be a good guide when standing in. There is a rocky patch of 9 fathoms 3 miles, and another of $9\frac{1}{2}$ and 10 fathoms $4\frac{1}{2}$ miles, E. by S. from Dunnose. The steep cliffs continue on from Dunnose toward Sandown, where they decrease in height, and the shore is low and sandy; they then gradually rise to Culver Cliff, close to the westward of which is a cliff of red clay, which contrasts strongly with the chalk of Culver Cliff. From the pitch of the latter, 213 feet high, the land gradually rises to the crest of Bembridge Down, on which stands a fort. Yarbrough monument stands on Culver Down, 312 feet above high water, and is a conspicuous object from seaward.

White Cliff
Bay.

Culver Spit, with $4\frac{1}{2}$ fathoms water over rocky bottom, extends nearly $1\frac{1}{2}$ miles southeast from Culver Cliff, and within it, close to the eastward of the cliff, is White Cliff Bay, where a limited extent of clear ground affords tolerable shelter out of the stream, with the wind off shore, for small vessels waiting tide. The east pitch of the cliff, W. $\frac{3}{4}$ N., and the coast-guard watch-house, N. by E., will place a vessel half a mile off shore in $2\frac{1}{2}$ fathoms water. A small reef, the outer part of which dries at low tide, extends nearly one-eighth of a mile from the base of Culver Cliff; and a large rock called the Shag, which covers only at high water springs, lies at the point of the cliff.

Culver Cliff to
Bembridge Point.

From Culver Cliff the land gradually decreases in height until it terminates in Bembridge Point, which is low. Midway between the cliff and the point is a place called Black Rock, where the coast-guard watch-house, a conspicuous white cottage, stands on the edge of the bank, 89 feet above high water. From Black Rock to Bembridge Point the coast is fringed by one unbroken rocky shelf, uncovering at low water nearly $\frac{1}{3}$ mile from the shore. These rocks are high, and steep to at their outer edge, and over many parts there is not more than 3 to 4 feet at high-water springs; outside them the depth increases to 2 fathoms, which will be found throughout at the distance of half a cable-length. Within their margin, just inside the point called the Sharpus, on a small sandy patch which dries at low water, the fishermen find a valuable shelter for their small boats during the fishing season. As Bembridge Point is approached,

Foreland farm will be observed, which is a useful and well-known sea-mark.

A life-boat is stationed at Bembridge.

Life-boat.

Bembridge Ledge extends $\frac{3}{4}$ mile off Bembridge Point, and has 18 feet over its outer edge. A considerable part of it dries at half tide, terminating in a high sharp point named Sharpus, about $\frac{1}{3}$ mile off shore in a S. E. by E. direction, rather more southerly than the main body of the shoal; there is not more than 5 feet over its outer extremity, even at high-water springs. There is a checkered black and white can-buoy in 4 fathoms on the outer edge of the ledge, with Bembridge Church midway between the life-boat house and the red house next west of it, N. W. by W. $\frac{1}{2}$ W.; the center of Horse fort on with the center of Southwick fort on Portsdown Hill, N. $\frac{3}{4}$ E.; Warner light-vessel N. $\frac{3}{4}$ E., 2.7 miles; and Nab light-vessel E. $\frac{3}{4}$ N. $2\frac{1}{2}$ miles.

Bembridge Ledge.

Bembridge mill on with the highest part of Brading down, W. N. W. $\frac{1}{4}$ W., and the Dock mill at Southsea on with the large chalk-pit on Portsdown Hill, N. by E., will serve as close marks for the edge of the shoal in 4 fathoms, should the buoy be removed.

On the northern part of Bembridge Ledge is Cole Rock, which shows at spring tides, and dries in several heads for more than a cable-length N. W. and S. E. From its center St. Helens Church is just open south of St. Helens Sea-mark, (a stone structure on shore $\frac{1}{4}$ mile S. S. W. from St. Helens Point,) N. W., and the face of Culver Cliff is just within Bembridge Point, between Foreland farm and Foreland village, S. W. by W. $\frac{1}{2}$ W.

Cole Rock.

An irregular shoal, called the Dawe Banks, lies about one-third of the distance from Cole Rock to Bembridge Ledge buoy, with not more than 8 feet water on its shoalest part. St. Helens Church a quarter of a point open northward of the Sea-mark, N. W. $\frac{1}{4}$ W., leads north of Cole Rock and Dawe Banks; and Black Rock watch-house, in line with the north end of the chalk-pit on Culver down, W. $\frac{3}{4}$ S., leads southward of them. These are useful marks for small vessels, for, although the latter may be considered as leading full close, it will carry a depth of 2 fathoms at low water. When northward of Cole Rock, or when Culver Cliff is well open north of Foreland farm, St. Helens Church should be opened more of the Sea-mark, to insure

Dawe Banks.

clearing the tail of the shoal, which extends some distance northward of the rock.

Shoals off east
end of Isle of
Wight; Princess-
sa Shoal. Princessa Shoal is an extensive and irregular patch of foul ground, the middle of which is about E. S. E. 2 miles from Culver Cliff. It is nearly $1\frac{1}{2}$ miles long E. by S. and W. by N., and rather more than $\frac{1}{2}$ mile broad near its western end. The depths over it vary from $3\frac{1}{4}$ to 5 fathoms, the shallowest part being near the northwestern edge, where there is a ridge $\frac{1}{2}$ mile long E. and W., with as little as 19 feet over it at low water; but as there are several shoal heads of 22 to 24 feet, vessels of great draught should avoid it.

Close to its northwest edge, in 32 feet, is a can-buoy striped vertically black and white, with Sandown fort just open of Culver Cliff, W. by N.; Nettlestone Point and Bembridge Point in line N. by W. $\frac{1}{4}$ W.; and Dunnose W. by S. $\frac{3}{4}$ S., 6.4 miles. A conical buoy, checkered black and white, with staff and cage, lies in 29 feet on the southeastern edge of the shoal, with the red-clay cliff in Sandown Bay just open of Culver Cliff, W. N. W. $\frac{1}{2}$ W.; a high round tree on St. Helens down in line with the flag-staff on Bembridge Point, N. N. W. $\frac{3}{4}$ W.; Warner light-vessel, N. 4.1 miles; Nab light-vessel, N. E. $\frac{1}{2}$ E. 2.6 miles.

The northern sharp shoulder of Appuldercomb Hill in line with Shanklin railway-station, W. $\frac{1}{4}$ N., leads south of the Princessa; the spire of Bembridge church, on with Foreland farm, N. W., leads north of it; and Bembridge fort, its apparent breadth inside Nettlestone Point, N. N. W. $\frac{1}{4}$ W., clears its eastern side. The red-clay cliff in Sandown Bay, kept open south of Culver Cliff, W. N. W., will also lead south of this shoal; and it may be avoided at night or in thick weather by not standing into less than 10 fathoms at low water.

Outer Nab
Rock.

The Outer Nab Rock is a small patch of foul ground, $1\frac{1}{2}$ miles S. W. $\frac{3}{4}$ S. from the Nab light-vessel, and as there is only $4\frac{1}{2}$ fathoms on its shoalest part it should be avoided by vessels of great draught. Bembridge mill on with the southwest end of Foreland village N. W. by W., leads southward of the patch; and Bembridge church on with Lane End farm, N. W. by W. $\frac{3}{4}$ W., leads northward of it. The barracks, or the coast-guard houses on the brow of the bank at Sandown, in line with Culver Cliff, W. $\frac{1}{2}$ N., leads between it and Nab Shoal in 5 and 6 fathoms.

Although the water deepens suddenly to 6 or 7 fathoms to the eastward of Bembridge Ledge, the rocks soon rise again and extend off a considerable distance under the general name of Nab Shoal, the body of which is about a mile long N. W. and S. E., and a quarter of a mile broad, with numerous shoal spots of 25 to 27 feet water.

Nab Shoal.

Near the center of this shoal is Nab Rock, a small head with 23 feet over it at low water. On its southeast side, in $4\frac{1}{2}$ fathoms, is a can-buoy striped horizontally black and white; with Asheydown tower, midway between Bembridge church and the life-boat house, W. N. W. $\frac{1}{2}$ W.; the east end of Eastney barracks on with the end of Widley fort on Portsdown Hill, N. by E.; Nab light-vessel, E. by N. $1\frac{1}{2}$ miles; Warner light-vessel, N. by W. $2\frac{3}{4}$ miles.

Nab Rock.

A considerable extent of foul ground, called Long Rock, lies northwest of Nab Shoal, on which are several heads of 23 to 25 feet water. From the shoalest head, Culver Cliff is nearly half a point open northward of Lane End farm; and the southeast end of St. Helens water-mill (a white building on the north side of Brading Haven) is in line with the north end of the ferry-house on the shingle-point at the north side of the entrance.

Long Rock.

The New Grounds are several shoal spots of gravel, sand, and broken shells lying to the westward of the Nab light-vessel. There is as little as $4\frac{1}{2}$ fathoms on the shoalest part, which lies W. N. W. $\frac{1}{2}$ W. a little more than a mile from the light-vessel. The ground in this locality is very irregular, with several patches of 5 fathoms or less, which are all comprised within the following limits, viz: The northern sharp shoulder of Appuldercomb Hill in line with Shanklin railway-station, W. $\frac{1}{4}$ N.; and the Nab light-vessel, N. by E. $\frac{1}{2}$ E.

New Grounds.

The Nab light-vessel is moored in $5\frac{1}{4}$ fathoms, 3 miles E. of Bembridge Point, on the outer edge of the shoals off the east end of the Isle of Wight. The vessel is painted red, with the name "Nab" on her sides, and has two masts, with a ball at each mast-head. A light is shown from each mast; that on the main-mast is 38 feet, and that on the fore-mast 28 feet above the sea; they are 54 feet apart, and should be visible in clear weather from the respective distances of 8 and 6 miles. A gun is fired if a vessel is seen standing into danger, and a gong is sounded during foggy weather.

Light-vessel.

From the light-vessel Portsmouth church tower is in line with Southsea castle light-house, N. by W. $\frac{1}{2}$ W.; Kicker-gill tower is in line with the east end of Fort Monkton, N. N. W. $\frac{1}{2}$ W.; the north tower of Osborne is just open of the easternmost trees near Ryde, N. W. $\frac{3}{4}$ W.; Warner light-vessel bears N. W. $\frac{1}{2}$ N. a little more than 3 miles, and Owers light-vessel S. E. $\frac{3}{4}$ E. $12\frac{1}{2}$ miles.

Saint
Road. Helens

St. Helens Road is well sheltered from all but southeasterly winds, and affords anchorage to vessels of any size, with excellent holding-ground of mud and stiff blue clay. The best position for heavy ships is in 7 or 8 fathoms, with Asheydown tower in line with Bembridge fort, W. $\frac{1}{4}$ N., or St. Helens Sea-mark just open southward of Bembridge fort; and the spire of St. Jude's church, Southsea, just open west of Horse fort, N. $\frac{1}{2}$ E.; but smaller vessels may anchor farther in with the former marks on, according to their draught.

Directions.

For ships of moderate draught there is a clear and safe channel, half a mile wide, between the N. W. Princessa buoy and the shore, and between the Bembridge Ledge and Nab Rock buoys, which may be useful, in fine weather with leading winds, to vessels bound to St. Helens Road; but under no circumstances should ships attempt to work through, for no good turning-marks can be given, and as the tides are strong they would be in some danger if caught with light and baffling winds near Bembridge Ledge, particularly as the western stream, when free from the influence of the channel, has a strong tendency to set over that shoal. The saving of distance to St. Helens Road from the offing by this channel is trifling, and as the course depends on a single bearing of the Nab light-vessel, the position of which might possibly be affected by heavy gales, it is not recommended except in case of necessity. Should circumstances, however, render it advisable, bring the Nab light-vessel to bear E. N. E. $\frac{1}{4}$ E., which will lead over Culver Spit in $4\frac{1}{2}$ fathoms and through the channel in 5 to 6 fathoms, and when St. Jude's church, Southsea, opens east of Horse fort, N. $\frac{1}{4}$ E., steer for it, or for the Warner light-vessel, N., either of which should lead through nearly in mid-channel between Bembridge Ledge and Nab Rock in not less than $4\frac{1}{2}$ fathoms. When Asheydown tower comes on with Bembridge fort, W. $\frac{1}{4}$ N., or St. Helens Sea-mark is just open southward of

the fort, anchor in St. Helens Road as above directed, or proceed on to Spithead.

This channel should not be attempted at night, but if it is unavoidable, bring the Nab lights E. N. E. $\frac{1}{4}$ E., and steer for them on that bearing until the Warner light bears N., when steer for it, and anchor in St. Helens Road when the green light on Bembridge fort bears W. $\frac{1}{4}$ N., or pass eastward of the Warner light for Spithead.

Large vessels intending to anchor in St. Helens Road, after rounding the eastern side of the Nab light-vessel at a moderate distance, should steer for Horse fort until Bembridge fort bears W. N. W. $\frac{1}{4}$ W., and then alter course to W. N. W., making allowance for tide; depths of not less than 5 fathoms will be carried through to the anchorage in 7 to 8 fathoms, as described above.

Large vessels beating into St. Helens Road should not stand farther southward than to have Foreland farm on with the eastern chalk-pit on Bembridge Down, which clears Nab Shoal and New Grounds; nor farther northward than to have the summit of Brading Down in line with St. Helens Sea-mark, which clears St. Helens Patch. When working in at night, with the Nab lights to the southward of E. $\frac{1}{4}$ S., a vessel standing to the eastward should go about as soon as the Warner light bears N. W. by W., which will be a sufficient warning of approach to the Dean Tail. When standing to the westward, the Warner light N. $\frac{1}{2}$ E. is quite far enough.

Brading Haven is of considerable size at high-water springs, but at low water it is little more than an extensive bank of bare mud, with a few patches of sand and gravel, over most of which there is not more than 3 or 4 feet at any time. From the shingle-points at the entrance the sands dry at the lowest tides to a considerable distance out. The southern side of the channel at the entrance is marked by beacons, the outer one of which is surmounted by a basket. The bank on the northern side is thickly interspersed with large stones and masses of rock; on the outer end is a small beacon buoy. Abreast the outer beacon is a bar of sand, gravel, and stones, which dries across, being about a foot above low water; 12 or 13 feet may be carried over it at high-water springs. Within the high-water points a few small vessels of 5 or 6 feet draught may lie afloat in

Brading Haven.

a small hole on the southern side. A narrow and intricate channel, not navigable at low water even for boats, leads up to Brading quay.

Light. At the northeast extremity of the bank extending off the south point of Brading Haven is Bembridge fort, in course of erection, from the scaffolding on the northeast side of which a fixed green light is displayed at an elevation of 38 feet.

Tides. Near the bar it is high water, full and change, at 11h. and low water at 5h.; springs rise 14 feet, neaps 10½ feet. At Brading quay it is high water nearly at the same time, but it does not commence rising until 2½ hours after the flood has made at the entrance. The rise at springs is 9 feet.

Saint Helens Patch. Near Brading Haven a bank extends off E. N. E. 1½ miles from St. Helens Sea-mark, at which distance there is about 4½ fathoms at low water, rapidly falling into 10 and 11 fathoms. A small bank of gravel and stones called St. Helens Patch, with only 17 feet over it, and 21 and 22 feet on its western side, lies about ½ mile within the edge of the bank, with Ryde church just shut in with Nettlestone Point, N. W. ½ W.; and the coast-guard mast on the southern side of Brading Haven in line with the eastern chalk-pit on Bembridge Down, S. W. ¼ S.

St. Helens Sea-mark in line with the summit of Brading Down, W. ¾ S., leads to southward of the patch, and Ryde church open of Nettlestone Point, N. W. ¾ W., to the northward of it. Large ships working up channel should not stand toward it into less than 10 fathoms.

Warner Shoal. Warner Shoal, composed of hard sand and gravel with shells, is 2 cable-lengths long, N. N. E. and S. S. W., and ½ cable-length broad, with only 16 feet over its shoalest part. The northeastern side is steep-to, the water deepening from 17 feet to 11 fathoms, about 60 yards from its edge. St. Helens Patch bears from it S. W. ¼ W. 1 mile, and Nettlestone Point W. ¾ N. rather more than 1½ miles.

Light-vessel. The Warner light-vessel, in 13 fathoms, on the eastern side of the bank, is painted red, with the name "Warner" on her sides, and carries a ball at her mast-head. The light, which revolves every minute, is 38 feet above the sea, and should be visible from the distance of 8 miles. A gong is sounded in foggy weather, and a gun fired if a vessel is

seen standing into danger. From the Warner light-vessel St. Helens water-mill is half its breadth open of St. Helens sea-mark, S. W. by W. $\frac{1}{4}$ W.; the outer end of Ryde Pier is seen between the towers of Osborne, N. W. by N. $\frac{1}{4}$ W.; No-man's Land fort bears N. W. $\frac{1}{2}$ N. $1\frac{1}{4}$ miles; Horse fort N. by E. $1\frac{1}{4}$ miles; Horse Elbow buoy N. E. by N. $\frac{3}{8}$ mile; and Dean Tail buoy S. E. by E. $\frac{1}{2}$ E. 3 miles.

No-Man's Land bank is of much greater extent, and is more dangerous than Warner Shoal, as it has only 7 or 8 feet water near its eastern end, with an average of 9 feet at low-water springs. Its eastern edge is steep-to, the lead dropping suddenly from 8 or 9 feet to 16 fathoms, and only very small vessels can pass between it and the island at low water. The surface of the bank is principally gravel and shells, but so hard as to render it dangerous for vessels grounding on it; between it and the island are weeds and mud.

No-man's Land.

Near the eastern extremity of this bank a fort is being constructed, from which a fixed red light is exhibited at an elevation of 38 feet above high water. Ships should not approach the fort within 2 cable-lengths.

Light.

Ryde Sand, dry at low-water springs, extends along the island shore between Nettlestone Point and Ryde, the Sand-head, its outer extremity, being about a mile off shore. A checkered black and white can-buoy is placed off the Sand-head in 28 feet, with Kickergill tower on with the center of the fort on Gilkicker Point, N. $\frac{1}{4}$ E.; the outer end of Ryde pier in line with the flag-staff on Wootton Point, W. by N.; and No-Man's Land fort S. E. by E. $\frac{1}{4}$ E. $1\frac{1}{4}$ miles. This flat should be approached with caution, as its outer edge is steep-to. Vessels may safely stand toward it into 10 fathoms, but should not pass southward of the buoy. Quarr house on with the end of Ryde pier, W. $\frac{1}{2}$ N., just clears the northern edge of the sand.

Ryde Sand.

The Horse and Dean Sand is an extensive shoal extending out to a great distance from the shore on the northeast side of the channel to Spithead. It is composed of coarse sand mixed with gravel and broken shells, with but little water over any part; from 6 to 9 feet is the average depth in the shoalest place. The western edge of this shoal extends from Southsea castle about S. by W. nearly 2 miles to Horse fort, where it is very steep. The southwestern edge

Horse and Dean Sand.

extends from Horse fort to the southeastward nearly 3 miles, the southeasternmost part being known as the Horse Tail. It is steep-to in some parts, especially between Horse fort and Horse Elbow buoy.

The Dean Tail buoy is the outermost buoy on the north-eastern side of the channel into Spithead. It is a conical black buoy with staff and ball, and lies in 5 fathoms, just outside the depth of 4 fathoms, with Asheysdown tower in line with St. Helens Sea-mark, W. $\frac{1}{2}$ N.; the east end of Blockhouse fort just open of Southsea Castle Point, N. N. W. $\frac{1}{2}$ W.; Nab light-vessel bearing S. W. $\frac{3}{4}$ S. $1\frac{1}{2}$ miles; and Warner light-vessel N. W. by W. $\frac{1}{2}$ W. 3 miles.

The Dean Elbow buoy is a black can-buoy in 5 fathoms, with the south side of No-Man's Land fort in line with Old Castle Point, N. W. by W. $\frac{1}{4}$ W.; the water-tower at Eastney Barracks in line with the east end of Southwick fort on Portsdown hill, N. $\frac{1}{4}$ W.; and Nab light-vessel bearing S. $\frac{3}{4}$ E. 1.7 miles.

The Dean buoy is a black can-buoy in 6 fathoms, about a cable-length from the edge of the shoal, with the water-tower at Eastney barracks in line with the west end of Southwick fort on Portsdown hill, N. by E. $\frac{1}{4}$ E.; Upton mill, near Ryde, on with the upper corner of a triangular field near Nettleston Point, W. $\frac{1}{4}$ N.; Warner light-vessel bearing W. $\frac{3}{4}$ S.; and Nab light-vessel S. S. E. $\frac{1}{4}$ E. $2\frac{3}{4}$ miles.

The Horse Elbow buoy is a black can-buoy in 5 fathoms, with Kickergill tower in line with the northeast end of Fort Monkton, N. N. W. $\frac{1}{2}$ W.; Asheysdown tower just open south of the houses on Nettlestone Point, W. S. W. $\frac{3}{4}$ W.; Warner light-vessel bearing S. S. W. $\frac{3}{4}$ W. 0.8 miles; and Horse fort N. by W. $\frac{3}{4}$ mile. There is 10 fathoms within a cable-length of the buoy.

The Boyne buoy is a green nun-buoy in 30 feet water near the wreck of the Boyne on the western edge of the Horse Sand, with the east Swashway beacon half-way between St. John's chapel and the east end of the trees on Portsmouth lines, N. $\frac{1}{4}$ E.; and the Dock mill in line with the London road over Portsdown hill, N. E. by N. There is only 19 feet water over the wreck, and the buoy should be passed on its western side.

Light.

Horse fort, at the western angle of Horse Sand, is distant rather more than a mile from No-Man's Land fort on

the opposite side of the channel. A fixed light is displayed from it at an elevation of 34 feet above high water.

Spithead is a capacious and secure roadstead, sheltered from the violence of southeasterly gales by the Horse and Dean Sand, and the shoals off Nettlestone Point. From the best anchorage, Southsea castle bears between N. E. and E. by N., and Gilkicker Point between N. W. and N. N. W. A good berth for large ships is in 10 to 12 fathoms, with Kickergill tower on with the red and white mile-mark on the western end of Fort Monkton, N. by W. $\frac{3}{4}$ W.; and the light-house on Southsea castle on with the north end of Spit fort, N. E. by E. $\frac{1}{2}$ E.; but vessels of moderate draught may anchor nearer the Spit Sand, in about 7 fathoms, taking care not to open Kickergill tower to the eastward of the east end of Fort Monkton barracks.

The magnetic variation at Spithead was $20^{\circ} 28'$ W. in 1870, decreasing at the rate of about $7'$ annually.

At Spithead, and anywhere between the Bramble and Horse Sands, the eastern stream, at full and change, makes at 2h. 0m., and runs 7 hours S. E. by S.; and the western stream at 9h. 0m., running 5h. N. W. by N. This inequality is caused by a strong counter stream running for 2 hours from Southampton water to Bembridge; for as soon as the western stream at Spithead has slacked, the rapid discharge from Southampton water and Portsmouth Harbor reverses its direction, and it flows to the eastward until it meets the channel ebb near the Nab, and the confluent streams sweep round to the southward of the Isle of Wight.

At the Dean Elbow, the eastern stream which sets over the shoal makes at 2h. 0m., runs to the S. E. for 2 hours, and then E. for the remainder of the tide, $5\frac{1}{2}$ hours; the western stream makes at 9h. 45m., and runs W. N. W. $4\frac{1}{2}$ hours.

Near the Horse Elbow the tide must be strictly attended to, for in many cases it sets directly over the shoal. The eastern stream makes at 2h. 0m., or $2\frac{1}{2}$ hours after the tide on shore, and runs to the S. E. $7\frac{1}{2}$ hours; the western stream makes at 9h. 15m., or $4\frac{3}{4}$ hours after low water on shore, and runs nearly 5 hours to the N. W.

At Warner Shoal the eastern stream makes at 2h. 0m., and runs $7\frac{1}{2}$ hours about S. S. E.; and the western stream at 9h. 30m., running nearly $4\frac{1}{2}$ h. N. N. W.

At Nab Rock the tidal stream is nearly rotary, which is

probably caused by the meeting of the Spithead tide with that round Dunnose; for instance, at the 1st hour's flood by the shore it sets E.; 2d and 3d hours, E. N. E.; 4th, N. E.; 5th, N. E. by N.; 6th, N.; 7th, N. N. W. to N. W.; and the last drain of the flood, N. W. by W. The 1st hour's ebb sets W. by N.; 2d, W. by S. to W. S. W.; 3d, S. W. by W. to S. W.; 4th, S. W. $\frac{1}{2}$ S.; and the first part of the 5th hour, S. S. W., gradually turning to the southward until low water by the shore, when its direction is S. E. Slack-water continues only a few minutes. At full and change the western stream makes at 11h., and the eastern stream at 4h. 30m. As the latter sets for 5 hours toward Bracklesham Bay and the entrance of Chichester Harbor, the mariner must be on his guard, especially in thick weather.

At the N. W. Princessa buoy the western stream makes at 10h. 0m., and runs 6 hours W. S. W. $\frac{1}{2}$ W. The eastern stream commences at 4h. 0m., and sets nearly E. N. E. At the S. E. buoy the tides are about half an hour later; the western stream first runs W. $\frac{3}{4}$ S., gradually becomes more southerly, and at the last of the tide runs S. W. by S.; the eastern stream runs nearly E. by N. through the whole tide.

The greatest velocity is as follows: At the Princessa Shoal, eastern stream nearly 2 knots, western stream $2\frac{1}{2}$ knots; at Nab Rock, eastern stream about 1, western stream $1\frac{1}{2}$ knots; at the Dean Elbow, eastern stream $1\frac{3}{4}$ knots, western stream $1\frac{1}{2}$ knots; at Warner Shoal, eastern stream $1\frac{1}{2}$ knots, western stream 2 knots; and at Spithead, eastern stream $1\frac{1}{2}$ knots, and western stream $1\frac{3}{4}$ knots.

Directions:
from the west-
ward.

From about a mile off Dunnose to the same distance south of the S. E. Princessa buoy the course and distance is about E. by N. $\frac{1}{4}$ N. $6\frac{3}{4}$ miles, varying according to the direction of the wind and set of the tide. The Princessa Shoal will be avoided by keeping the red-clay cliff, next westward of Culver Cliff, open to the southward of the latter; or the sharp northern shoulder of Appuldercomb Hill in line with Shanklin R. R. station W. $\frac{3}{8}$ N., until abreast of the S. E. Princessa buoy. About $\frac{1}{2}$ mile outside Princessa Shoal depths of 7 to 8 fathoms at low water will be maintained, the nature of the bottom being changeable, but generally gravel and broken shell, interspersed with numerous patches of foul ground. Nearly abreast the Nab, and thence to the

New Grounds, less water may be expected, and even an occasional cast of as little as 5 fathoms, almost invariably gravel and broken shells.

After rounding the S. E. Princessa buoy the vessel, if of moderate size, may haul to the northward and steer about mid channel between Bembridge Ledge and Nab Rock, with St. Jude's church, Southsea, just open east of Horse fort, N. $\frac{1}{4}$ E., or for the Warner light-vessel, N., the least water in this route being $4\frac{1}{2}$ fathoms; the above marks will lead to the eastward of the Warner light-vessel, up to the line of the leading mark into Spithead, which is Kickergill tower on with the middle of Fort Monkton barracks, N. N. W. $\frac{1}{4}$ W. After passing No-man's Land and Horse forts, a suitable berth for anchorage may be selected, according to circumstances.

There is an available channel for small vessels between Nettlestone Point and Warner Shoal, the leading mark for which is Kickergill tower on with No-man's Land fort, N. by W. $\frac{3}{4}$ W., which will lead through from seaward, east of the Princessa Shoal and inside Nab Rock until Spit fort and the round tower at Portsmouth Point are in line, N. $\frac{1}{2}$ E.; these will lead into the fairway channel to Spithead. The least water will be $3\frac{1}{2}$ fathoms inside Warner Shoal.

A ship of great draught, from about a mile southward of the S. E. Princessa buoy, should steer to the northward and eastward, not passing northward of the clearing-mark for Princessa Shoal (the sharp northern shoulder of Appuldercomb Hill on with Shanklin R. R. station, W. $\frac{3}{4}$ N.) until Nab light-vessel bears N. by E., when steer for her; by doing so all the shoal patches of 5 fathoms and less, in the vicinity of the outer Nab, will be avoided. After passing about a cable-length east of the light-vessel, steer for No-man's Land fort, about N. W. $\frac{3}{4}$ N., until Kickergill tower comes on with the middle of Fort Monkton, N. N. W. $\frac{1}{4}$ W., when proceed with these marks on, and select an anchorage at Spithead.

When nearing the Nab light-vessel at low-water springs, during bad weather with a heavy sea, it might be necessary for ships of great draught to approach from a more easterly direction, in order to preserve a depth of not less than 6 fathoms. To do this, pass $\frac{3}{4}$ mile to the southeastward of the Nab light-vessel, and then steer to the northward toward

Dean Tail buoy, until Warner light-vessel bears N. W. $\frac{1}{2}$ W., when steer for her on that bearing until the leading marks to Spithead come on.

From the east.
ward.

On approaching the Nab light-vessel from the eastward a ship of moderate draught might bring Kickergill tower in line with the middle of Fort Monkton, N. N. W. $\frac{1}{4}$ W., and proceed through to Spithead with this mark on; but vessels of great draught should pass eastward of the Nab light-vessel, as above directed. As it not unfrequently happens that Kickergill tower and Fort Monkton are difficult to identify from haze, or are partially hidden by shipping at Spithead, it is well to bear in mind that Spit fort, just open east of Horse fort N. by W. $\frac{3}{4}$ W., will lead even vessels of great draught in safety to a mid-channel position, between the Dean and Dean Elbow buoys, whence there will be no difficulty in picking up the leading marks for proceeding to Spithead. The least water in this route is $5\frac{1}{2}$ fathoms.

Working in.

When working to windward ships may stand between Dean Tail and Dean buoys into 8 fathoms at low water; but between Dean buoy and Horse fort the sand is steep-to, and should not be approached within the depth of 15 fathoms. Horse and No-Man's Land forts are of great service, standing as they do near the edges of their respective shoals, but strict attention to the lead is necessary. A vessel of great draught, beating through St. Helens Road, should not stand farther to the southward than to have Foreland farm on with the eastern chalk-pit on Bembridge Down; this will clear Nab Shoal and the New Grounds, but to avoid the $4\frac{3}{4}$ -fathom patch, between the latter and Long Rock, the chalk-pit should not be brought farther than Lane-end farm. In making the northern board do not stand farther than to have the summit of Brading Down on with St. Helens Sea-mark, which clears St. Helens Patch. Kickergill tower on with the west end of the barracks in Fort Monkton will lead outside Warner Shoal, and the tower turned from end to end of the barracks will clear the shoals on both sides; a vessel of great draught, however, must not bring the tower to the extreme end of the barracks, but should go about when it is twice its own breadth from the end until she is at least 2 cable-lengths northward of the Warner light-vessel, when the tower may be safely

brought on with the west end of the barracks, taking care not to stand into less than 15 fathoms at low water, which will be a safe guide until past No-man's Land fort. The tides must be strictly attended to when working to windward near these shoals.

Although 15 fathoms is a good guide for a vessel working between Warner Shoal and No-man's Land, and abreast them, nothing less is safe; after having passed westward of No-man's Land fort she may safely stand into 12 fathoms, which will be found a safe depth up to the east end of Sturbridge Shoal.

As the tide runs through the channel into Spithead with considerable strength at springs, vessels of light draught will frequently find it advantageous to run over Horse Sand, and not confine themselves to the fairway; but when this is done the rise of tide should be carefully considered. From half flood to half ebb a vessel not drawing more than 12 feet may borrow on the Horse Sand as long as Block-House fort is open of Southsea castle, and if under 9 feet draught she may do so from quarter-flood to three-quarters ebb, as the shoalest water outside this line is about 7 feet at springs.

At night a vessel of moderate draught abreast Dunnose may steer to the eastward with St. Catherine light just open of the land, bearing about W. by N. until the Nab lights bear N. E. $\frac{1}{2}$ N.; or if a mile off Dunnose an E. by N. course will lead about the same distance outside Princessa Shoal, taking care not to stand into less than 10 fathoms at low water until Nab lights bear N. E. $\frac{1}{2}$ N., when steer for them. When Warner light bears N. N. W. alter course for it, and after rounding the light-vessel at a convenient distance on its eastern side proceed in mid-channel about N. N. W. between the lights on Horse and No-man's Land forts, and anchor at Spithead in about 6 fathoms, with Warner light S. by E. $\frac{1}{2}$ E., and the green light on Southsea castle N. E. $\frac{1}{2}$ E.; or otherwise, as most convenient. This route skirts Outer Nab Rock, but even supposing it to be crossed, the least depth is $4\frac{1}{2}$ fathoms.

At night.

When South sea castle light is first seen, N. by E., it will appear red; the vessel will then be to the westward of Horse Sand and have the Portsmouth channel open. It changes from red to green when bearing N. E. by N.

A ship of great draught off Dunnose, with St. Catherine light just visible, W. by N., and Nab lights N. E., should steer N. E. by E. $\frac{1}{2}$ E., until Nab lights bear N. by E., and then steer for them. This will clear all the patches of 5 fathoms in the vicinity of the outer Nab. After rounding the light-vessel at a convenient distance on its eastern side, steer for Warner light on a N. W. bearing, and when Spit fort light opens west of Horse fort light, a N. N. W. $\frac{1}{2}$ W. course will lead between the lights on Horse and No-Man's Land forts, and through to Spithead.

Portsmouth.

Just westward of Gilkicker Point is a large inlet, in which are Portsea, Hayling, and Thorney Islands. Between the western side of this inlet and Portsea Island is Portsmouth Harbor, the approach to which is defended by Gilkicker, Monkton, and Block-House forts on the western side, and Southsea castle at the southwestern extremity of Portsea Island. A mile within the castle is the entrance of the harbor, 700 feet wide at low water, between Block-House fort on the western, and the Round tower on the eastern side. Within the entrance the harbor widens out and merges into Fareham and Porchester Lakes, from which several smaller lakes branch out in different directions. These lakes are bordered by mud-banks, covered at high tide, the whole then forming an expanse of water $2\frac{1}{2}$ miles north and south, and about the same east and west.

The general width of the channel within the harbor is about 2 cable-lengths, with irregular depths from 8 to 3 fathoms; it is however considerably narrowed by Ballast and Burrow Banks, which project from the western shore. Ballast Bank begins just within Block-House Point, and extends N. N. E. upward of $\frac{1}{4}$ mile, its northern end being nearly half way across the channel. It is about 400 feet broad, with 8 feet least water near its southwest end, and 16 feet of water on its eastern side. Burrow Bank, composed of mud and stones, extends from the mud off Burrow Island half way across to the northwest angle of the dock-yard. It is $2\frac{1}{2}$ cable-lengths long, 2 cable-lengths wide, and has as little as 6 feet over it at low water.

Fareham Lake is about $1\frac{3}{4}$ cable-lengths wide at its entrance at low water; it then gradually narrows, with depths of $4\frac{1}{2}$ to 3 fathoms, to abreast Bomb Ketch and Spider Lakes; a mile farther the depth is only $1\frac{1}{2}$ fathoms.

The lake then bends to the W. N. W., and becomes narrow and shoal, there being only a foot at low water $\frac{1}{2}$ mile below Fareham. Porchester Lake has irregular depths, from 5 to 3 fathoms, decreasing to 6 feet just below Porchester castle. Its direction is north and northeast for about $2\frac{1}{2}$ miles, when it bends to the southeast and soon becomes a mere drain. Hilsea Creek, which separates the northern end of Portsea Island from the main, connects Portsmouth and Langston Harbors, and is crossed by a stone bridge.

The town of Portsmouth stands on the eastern side of the entrance of the harbor, and is inclosed by bastioned ramparts, surrounded by a deep moat and extensive outworks. On its north side, separated from it by Mill-dam Creek, is the town of Portsea, similarly fortified. On the west side of these towns, occupying the whole extent of the eastern shore of the harbor, are the Town cambers, the Gun-wharf, and H. Majesty's dock-yard.

The Town cambers are between Point at Portsmouth and the new Gun-wharf; they both dry out at low water, and are separated by a bridge. The area of the outer camber is rather more than 3 acres, exclusive of the dry-dock on its north side, which is 345 feet long, 50 feet wide at entrance, and $17\frac{1}{4}$ feet over sill at high-water springs. The area of the inner camber, in which there is a patent slip, is also about 3 acres. The patent slip is 450 feet long, and a vessel of 800 tons, drawing from 10 to 11 feet forward, and 15 feet aft, can be taken on it at high-water springs.

The government dock-yard contains dry-docks, building-slips, workshops, store-houses, &c., on an immense scale.

The western side of the harbor is fronted at low water by a mud-flat through which flow two narrow creeks, called Haslar and Weevil Lakes. Between them is the town of Gosport, and north of it the Royal Clarence victualing-yard, both inclosed on the western side by ramparts and a deep moat. About $\frac{1}{2}$ mile southwest of Gosport, and separated from it by Haslar Lake, is Haslar hospital, a brick building, covering a large extent of ground between Block-House and Monckton forts. The population of Portsmouth, Portsea, and Gosport, with their suburbs, was about 113,000 in 1861.

Greenwich mean time is shown daily by the dropping of Time-ball.

a black ball from the staff of the semaphore in Portsmouth dock-yard, at an elevation of 176 feet above the mean level of the sea. The ball is hoisted half way up the staff at 5 minutes before 1 p. m., and close up 3 minutes later, and falls at 1 p. m., Greenwich mean time. The semaphore is in lat. $50^{\circ} 48' N.$, lon. $1^{\circ} 6' 15''$, or 4m. 25s. W. of Greenwich.

Spit Sand.

Spit Sand is a triangular bank extending off the beach between Gilkicker Point and the entrance of Portsmouth Harbor to a distance of nearly $1\frac{1}{2}$ miles. It is composed of coarse calcareous sand and gravel, thickly mixed up with minutely-broken shells, with numerous patches of large stone along Haslar beach. The general depth over it is 7 to 10 feet, but some spots have as little as $4\frac{1}{2}$ feet. Spit fort stands $\frac{1}{2}$ mile within the 3-fathom line at the outer extremity of Spit Sand. A dangerous shoal, composed of hard, coarse sand, nearly 500 feet long and not broader than a boat, lies near the outer end of Spit Sand, and has only 3 feet over it at low-water ordinary springs.

Spit Sand buoys.

The Outer Spit buoy is a conical buoy checkered black and white, in $3\frac{1}{2}$ fathoms at the southern extremity of the bank extending off Spit Sand, with the eastern side of No-man's Land fort in line with Yarborough monument on Culver down, S. S. W. $\frac{1}{4}$ W.; Gilkicker Point N. W. $\frac{1}{4}$ W.; and Horse fort S. S. E. $\frac{1}{2}$ E. 1 mile.

Spit buoy is a checkered black and white refuge bell-buoy in 22 feet, at the southeast extremity of Spit Sand, with E. Swashway beacon half way between St. Paul's church and the west end of the large chalk-pit on Portsdown Hill, N. by E. $\frac{1}{2}$ E.; and Gilkicker Point N. W. by W. $\frac{1}{2}$ W. The depth between it and Outer Spit buoy is 20 to 23 feet.

Harrow Bank.

Harrow Bank is a shoal patch of gravel and stones extending about 2 cable-lengths from the beach near Monkton fort, which nearly dries at low water, and is much in the way of small vessels coming round Gilkicker Point or crossing over from Ryde. The cupola of St. Paul's chapel at Southsea in one with the flag-staff on the King's bastion leads more than a cable-length south of it.

Hamilton Bank.

Hamilton Bank, near the entrance to Portsmouth Harbor, dries in spots at the lowest tides, when there is only 5 feet water on its outer end nearly $\frac{3}{4}$ mile from Haslar beach. The new Gun-wharf clock-tower in line with the Round tower

leads between it and the beach in not less than 3 feet at low water.

The width of the channel between the end of the Outer Spit and Horse Sand is four-tenths of a mile, but it is narrowed considerably abreast Southsea castle by a projection from Spit Sand, called the Elbow, between which and the main body of the shoal there is a blind channel. Near the entrance there is a knoll of loose shingle, with 18 feet water over it, marked on its western edge by a black can-buoy in 19 feet, with Southsea Castle light-house N. by E. $\frac{1}{2}$ E. rather more than a mile; and Spit buoy N. W. by W. $\frac{1}{6}$ mile. A similar knoll with 22 feet lies S. W. $\frac{3}{4}$ S. from it. Southsea beach, with the exception of the shoal off Southsea castle, is steep-to, and may be approached to the distance of $\frac{1}{2}$ cable-length till abreast the Swashway beacons, where the channel is narrowed by the East Sand, a bank of sand and gravel which commences at the mouth of the harbor, and running parallel with the beach terminates in a spit nearly as far south as the beacons. The general depth on this sand varies from 7 to 10 feet; but the East knoll, a shoal patch of only 5 feet, lies a little to the northward of the baths, about $\frac{1}{2}$ cable-length from the beach. A deep gut, called Southsea Pool, runs up between East Sand and the beach, having 6 or 7 fathoms at its entrance; but it gradually narrows to a point, and decreases in depth as its northern end is approached.

The Bar is a gravel-bank which connects the eastern edge of the Elbow with the outer spit of the East Sand, and is steep-to on both sides; it has been dredged to 17 $\frac{1}{2}$ feet, so that the depth over it at high-water springs is 30 feet, and at neaps 27 $\frac{1}{2}$ feet. The channel is here narrow, but its limits are well defined by buoys. The leading mark through is the red beacon at the southwest end of Block-House fort in one with the black beacon on the Gosport fortifications, N. N. W. $\frac{1}{4}$ W.

The western or port side of the channel, above the Elbow, is marked by five buoys, checkered black and white. No. 1 buoy is placed near the southeast point of the Elbow in 30 feet water; No. 2 lies 1 $\frac{1}{2}$ cable-lengths northward of it; No. 3 upon the inner shoulder of the same bank in 12 feet; and Nos. 4 and 5 lie nearly in a straight line between No. 3 and Block-House Point, in 15 and 18 feet respectively, the whole clearly and accurately marking the west side of the channel.

Two black buoys, numbered 1 and 2, mark the western edge of East Sand, and must be left on the starboard-hand entering.

Ligh ta.

A fixed bright light is exhibited from a small turret on Spit fort, at an elevation of 34 feet above high water.

From a light-house in the north corner of Southsea castle a fixed light is exhibited at an elevation of 51 feet above high water, which should be visible in clear weather from a distance of 9 miles. It appears red in the channel between Spit refuge-buoy and Horse fort, or when bearing between N. by E. and N. E. by N.; and green to the westward of Spit buoy, or when bearing between N. E. by N. and E. $\frac{1}{4}$ N. Coming from the eastward, it is first seen when bearing N. by E., and is of a faint-red color; on that bearing it leads about 0.4 mile westward of Horse fort, and close to the Boyne buoy.

There are two fixed red gas-lights, one at each outer end of Clarence Esplanade pier, near the King's Rooms on Southsea beach; a fixed green light at the north outer end, and a fixed red light at the south outer end of Victoria pier, foot of High street, Portsmouth; and red or green lights are shown at different piers and landing-places within the harbor.

Tides.

It is high water, full and change, in Portsmouth Harbor at 11h. 41m., and low water at 4h. 30m.; springs rise $12\frac{1}{2}$ feet, neaps 10 feet. A narrow stream runs in 15 or 20 minutes after high water. Northeast winds keep the tides back; southwest winds have the opposite effect. The highest tide on record occurred November 13, 1840, during a heavy gale from the S. W., four days after full moon, when the water rose $17\frac{1}{4}$ feet.

The tide during the first 4 hours of flood rises 6 inches less than in the last 3 hours; and during the last 2 hours of ebb it falls 2 feet more than in the first 3 hours. The flood continues about 7 hours, and the ebb about 5 hours, and similar differences exist at Chichester, Langston, Southampton, and all the harbors of the Solent, as already remarked. During the first 4 hours of flood the water rises slowly and almost uniformly about 6 feet, apparently supplied by that portion of the incoming or eastern stream in the Channel which flows through the Solent. About $4\frac{1}{2}$

hours after the commencement of this stream, or about 9h. 30m. on full and change days, the western stream has made in-shore all along the coast, from Selsea Bill to the Bill of Portland. This western stream unites with the last of the eastern stream round the eastern end of the island, and runs back through Spithead, giving increased effect to the incoming stream of flood in the Channel, by contributing to fill the harbors in its progress to the westward in an accelerated degree, and also to prolong the duration of the rising tide until the stream has turned in the offing, a little after 11h., thus making a whole flood or rising tide of 7 hours. So long as the western stream maintains its strength through Spithead, the water is kept up or prevented from falling out of Portsmouth Harbor, and this check continues until the stream at Spithead slackens, when both Portsmouth Harbor and Southampton water rapidly empty themselves.

On Spit Sand, with the Swashway beacons in line, the stream turns nearly at the same time as at Spithead. During the first 4 hours of flood it sets toward Southsea beach at the rate of $\frac{1}{2}$ knot to $\frac{3}{4}$ knot, and during the remaining 3 hours toward the harbor about $\frac{3}{4}$ knot. The ebb first sets W., then S. W. and S. E., and during the last 2 hours toward Spit buoy, at the rate of 1 to $1\frac{1}{2}$ knots.

At Spit refuge-buoy the streams turn a little later than at Spithead. The flood runs E. S. E., toward Langston bar, during the first 4 hours; during the 5th hour it turns and sets weakly toward Southsea castle; for the remainder of the tide it runs at the rate of about a knot toward the harbor. The direction of the ebb is the same as in the Swashway, but its rate is less. Off Southsea castle the flood turns a little earlier than at Spit buoy; its direction is the same, but its strength is greater. The ebb sets W. S. W., then S. and S. E. for the last 3 hours, with a velocity of $2\frac{1}{2}$ knots.

On the bar the flood makes toward the harbor at 8h. 15m., or $3\frac{1}{2}$ hours before high water. The first half sets, as in the Swashway, weakly toward Southsea beach; the rate of the latter half is about $1\frac{1}{2}$ knots, which increases to $4\frac{1}{2}$ knots at the entrance of the harbor, thence decreasing gradually to $2\frac{1}{4}$ knots abreast the dock-yard, and $1\frac{1}{2}$ knots off Hardway. The ebb does not make to the S. E. on

the bar until about 1h., being influenced by the Spithead tide; it runs weakly at first, but during the last 3 hours it sets through the harbor channel at the rate of $2\frac{1}{4}$ knots; at the 4th hour its rate at the entrance is $4\frac{1}{2}$ knots.

At Fareham, in the channel close to the upper town quay, it is high-water, full and change, at 11h. 47m., and low-water at 4h. 30m.; springs rise $11\frac{1}{4}$ feet above the level of low water, (when there is only 9 inches water in the channel,) and neaps rise $8\frac{1}{2}$ feet. At springs (two days after full and change) the tide begins to rise about $1\frac{1}{2}$ hours after, and at neaps 18m. after low water at Portsmouth. The flood stream ceases about high water at the quay, and stands about 10 minutes, when the ebb commences. At Fareham bridge, just below the mill, it is high water about the same time; springs rise $7\frac{1}{2}$ feet, neaps $4\frac{3}{4}$ feet. At springs the tide begins to rise at the bridge $4\frac{1}{2}$ hours after low water at Portsmouth.

In Porchester Lake, off the castle, it is high water at 11h. 45m., and low water at 4h. 35m.; springs rise $13\frac{1}{2}$ feet, neaps $10\frac{1}{4}$ feet. The flood stream ceases about a quarter of an hour after high water and stands about 7 minutes, when the ebb commences.

In Hilsea Creek, about $\frac{1}{4}$ mile west of Portsbridge, it is high water at 11h. 47m.; springs rise $6\frac{1}{2}$ feet above the bed of the channel, neaps 4 feet. This channel dries at springs $4\frac{1}{2}$ hours after high, or about 25 minutes before low water at Portsmouth, and at neaps at 3h. 35m. after high, or $1\frac{1}{2}$ hours before low water there, and remains uncovered $5\frac{1}{2}$ to 6 hours. At springs the tide begins to rise 5h. after low, or $2\frac{1}{2}$ h. before high water at Portsmouth, and at neaps $4\frac{3}{4}$ h. after low, or 2h. 40m. before high water there. A spring tide rises only for about 2h. 20m., a neap tide 2h. 45m.

Directions.

It is not prudent for large vessels to enter or leave Portsmouth Harbor without a pilot, but in small vessels such assistance is not absolutely necessary. It may however be taken as a general rule, that it is utterly useless to attempt entering against the tide, except with a commanding breeze or with steam, nor should a vessel venture to work in without a pilot. The best time for entering is near slack tide, about half an hour before high water, or upon the slack which occurs between the 2d and 3d hour's flood, which continues about three-quarters of an hour. The flood is

strongest between the 5th and 7th hours, and the ebb at the 3d and 4th hour, when its rate at the entrance is $4\frac{1}{2}$ knots.

Steer in with Southsea Castle light-house N. N. E. $\frac{1}{4}$ E., and if of heavy draught pass S. E. of Outer Spit buoy. Vessels of moderate draught may pass between it and Spit refuge-buoy, where there is 20 to 23 feet at low-water springs. After passing about a cable-length E. of Spit refuge-buoy, steer in with the outer Swashway beacon in line with Fitz-clarence monument N. $\frac{3}{4}$ E. until the red beacon in the west angle of Block-House fort (which appears over a black patch with a white border on the wall below) comes on with the black beacon in Gosport fort, N. N. W. $\frac{1}{4}$ W.; with this mark on proceed over the bar, leaving the checkered black and white buoys on the port hand, and the black buoys on the starboard hand, until the high-water mark of Block-House Point is on with the bakery chimney of Royal Clarence victualing-yard; steer on this mark, and when the Spur redoubt comes in line with King's Bastion flag-staff the course will be up the center of the harbor.

In sailing in with the tide, particularly at its strength, the utmost caution must be used; for what with the generally crowded state of the harbor, the constant crossing of the steam bridge, and the numerous boats continually in the vessel's track, it is always attended with great anxiety and some risk. On the flood in a small steamer, or with a slant of wind in a sailing-vessel, it is perhaps best to run well up the harbor past the thick of the shipping, and then turn the vessel's head upon the tide, which will afford time and give facility for taking up a berth; but upon the ebb the vessel may steer directly for her intended berth. Under all circumstances judicious and moderate sail, a steady and attentive helmsman, and an anchor in constant readiness, are necessary when entering the harbor.

Merchant-vessels incur a penalty by making fast to the Queen's buoys.

Vessels of moderate draught may cross Spit Sand at the proper time of tide. Coming from the southward, keep the dock-yard semaphore in line with the Round tower, and it will lead in 6 feet at low water eastward of Hamilton Bank.

Crossing from the westward keep a white stuccoed house on Southsea common in line with Dock mill until the semaphore comes on with the Round tower.

Across Spit
Sand.

The officers' houses at the entrance of Gun-boat yard showing just clear of the eastern part of Haslar hospital, lead along the western edge of Hamilton Bank in 6 feet water; and the Round tower in one with the Gun-wharf clock leads up in-shore of the bank in not less than 3 feet at low-water springs—a useful mark for small steamers at a proper rise of tide.

The Swashway beacons on Southsea beach in line, E. N. E. $\frac{1}{2}$ E., lead over Spit Sand in 8 feet water, midway between Hamilton Bank and a shoal patch, with 5 feet water, called the Elbow Knoll; and when St. Thomas church comes in line with the outer angle of Spur redoubt it will lead up to the Bar marks.

A depth of 8 or 9 feet at low water may be carried across by keeping the spire of St. Jude's church, at Southsea, in line with the east end of Charlton house (built of yellow and red bricks, at the back of inner Swashway beacon) until the tower of St. Thomas church comes on with the western or outer angle of the Spur redoubt; this latter mark will lead into the fairway, in not less than 9 feet at low water.

The marks for clearing the Ridge are, the outer Swashway beacon in line with the west tower of Pier hotel, and the Gun-wharf clock-tower in line with the outer angle of Spur redoubt. The new Gun-wharf clock-tower in line with the west or outer angle of Spur redoubt leads westward of it in not less than 8 feet at low water.

Langston Har-
bor.

Between Portsea and Hayling Islands is Langston Harbor, the entrance being E. $\frac{3}{4}$ S., $2\frac{1}{2}$ miles from Southsea Castle, between Cumberland fort and Gunnen Point. It is available for very small vessels only, as a bar nearly dry at low water extends about $1\frac{1}{2}$ miles off the entrance. Gravel banks, called the West Winner and East Winner, dry out at least a mile on both sides, and between them on the bar there is only a foot water at low spring tides. These banks frequently shift, and are seldom the same before and after a gale. In blowing weather, if any swell is up outside, it is one sheet of broken water between them, with heavy rollers. Haslar hospital open of Southsea Castle, N. W., leads southward of the banks in 9 feet at low water.

The north end of Hayling Island is separated from the mainland by Hayling Creek, which connects Langston and

Chichester Harbors, and is crossed by a swing-bridge; the width of the opening is 23 feet, and there is 12 feet in the channel at high-water springs.

The tide makes into the harbor, on full and change days, at 5h. 0m., and out, or to the southward, at 12h. 0m., which is 20 minutes later than high and low water by the shore; springs rise $13\frac{1}{2}$ feet, neaps $10\frac{1}{2}$ feet, but they are uncertain to the extent of a foot or two. Tides.

As the tide sets with great velocity between the entrance points of Langston Harbor and in the channel when the banks are uncovered, it would be useless for a sailing-vessel to attempt entering against it; the best time for running in is about an hour before high water. In running over the bar into the fairway channel of the harbor, bring the west end of the officers' houses in Cumberland fort in line with the eastern end of the large chalk-pit on Portsdown Hill, N. $\frac{3}{4}$ W.; and as soon as the water deepens the vessel will be in the channel, and a course may be steered between the points. There are no regular pilots for the harbor, and if none of the local fishermen are at hand the anchor should be dropped when in safety, and assistance waited for. Directions.

Hayling Bay is between Langston and Chichester Bars, and its shore, which is the south side of Hayling Island, is an uninterrupted line of shingle. It contains some shoal patches at a distance of nearly $1\frac{1}{2}$ miles off shore. The soundings on this part of the coast are so regular, and with a few exceptions the water shoals so gradually, that there can be no difficulty in keeping off a proper distance according to the vessel's draught. Hayling Bay.

A life-boat is stationed on Hayling Island.

Life-boat.

The entrance of Chichester Harbor is $3\frac{1}{2}$ miles eastward of Langston Harbor, and the watch-house on the eastern point bears N. N. W. $\frac{3}{4}$ W. $6\frac{1}{2}$ miles from Selsea Bill, and N. E. $\frac{1}{4}$ E. $5\frac{1}{2}$ miles from Nab light-vessel. A considerable trade is carried on here, but the entrance is bad, as the bar has only 2 feet over it at low-water springs; and a shoal flat, which is a continuation of the Horse and Dean Sand, extends off abreast it at least 2 miles, with not more than 15 feet water. The gravel banks, known as the East Pole Sand, dry off $1\frac{1}{2}$ miles from Watch-house Point, and change with every gale of wind and spring tide during the winter months. Their general direction is about W, S. W., thus Chichester Harbor.

throwing the entrance to the westward. On the western side a bank of inconsiderable extent, called the West Pole, runs out about $\frac{1}{2}$ mile from Eastoke Point. When there is any swell outside the sea breaks furiously over the sands, and even across the entrance, especially with southerly winds on an ebb tide.

Life-boat.

A life-boat is stationed at Chichester Harbor.

Tides.

It is high water, full and change, in Chichester Harbor at 11h. 30m.; just within the entrance springs rise 14 feet, and neaps 11 feet. About a mile outside the bar the set of the stream is nearly rotatory and of little strength, turning to the eastward at 4h. 50m., and to the southwest at 12h. 45m.; between the points, and in the channel over the bar, when the banks are uncovered, it runs with great force.

Directions.

A pilot will be found on the look-out at tide-time at the entrance, and no one who has not a thorough knowledge of the harbor should attempt to enter it without his assistance, as there are no beacons or buoys to mark the channel. Should circumstances, however, render it necessary to take the harbor without a pilot, care must be taken to preserve a tolerable offing until a proper rise of tide for entering; and for this purpose it should not be approached nearer than to have Haslar hospital just touching Southsea Castle, which will insure 3 fathoms at low water. In fine weather, with a smooth sea, an anchor should be dropped under foot if too soon upon the tide, and as the ground is everywhere good the position chosen must depend upon the direction of the wind. As there is no channel into the harbor, except to the westward of the East Pole, do not anchor farther eastward, with westerly winds, than to have the coast-guard watch-house to the eastward of Bow Hill.

Approaching from the southward or eastward, especially with the wind in that direction, the best mark for crossing the bar is the watch-house on Watch-house Point in line with a remarkable plantation to the eastward of Bow Hill, N. E. by E. $\frac{1}{2}$ E.; this will lead well into the fairway, and when there, of which the increased depth will give sufficient warning, steer up between the points in mid-channel, as on the strength of the tide the eddies are strong on both sides, within or without the points, according as it is flood or ebb.

If entering from the westward, run with Cackham tower in one with Berry barn, E. S. E. $\frac{1}{2}$ E., which will lead north-

ward of Hayling Knob, and over the bar in 17 feet at high-water springs; but as this line points to the highest part of the East Pole, do not continue on it longer than to bring the fairway mark on.

If bound to Emsworth, enter the Emsworth channel, which is close to the high shingle point on the western side of the harbor, and anchor until the assistance of a pilot can be obtained. As there is no avoiding the strong tide, which is very rapid on the ebb, a good look-out must be kept in the event of the vessel driving.

In the eastern or Chichester branch there is fair anchorage for many vessels of considerable burden; but a shoal flat connects Watch-house Point with Gardner Head, and a vessel to cross it in the best water must bring the old cottage at East Saltern in line with the high-water shingle point on the western side of Emsworth channel. This mark will lead to the anchorage, which may be said to commence about $\frac{1}{2}$ mile eastward of the watch-house, or soon after passing the coast-guard hulk, in 4 to 5 fathoms at low water. If intending to remain some time at this anchorage, it will be prudent to steady the vessel with a stream anchor, and for this purpose the small bower should be let go near the middle of the stream, and the small anchor carried over toward the southern mud; veer upon the bower, and heave in upon the stream, which will take the vessel out of the strength of the tide, and also out of the fairway, and she will have open hawse up the harbor, which is advisable, as the ebb rushes down with great rapidity. The bower will also be a safe precaution against driving over on the southern mud, of which there would be some danger in strong northerly winds.

Chichester Lake is navigable to Dell quay, within 2 miles of Chichester.

The coast between Chichester Harbor and Selsea Bill forms a low earthy bank, which is seriously encreached upon by the sea. Among many conspicuous objects useful as sea-marks are Oxtall barn, about half a mile eastward of Watch-house Point, and Berry barn, a large and remarkable building close to the shore about a mile eastward of the same point. West Wittering church, with a spire, is conspicuous, and is a short distance inland. Cackham tower is a high brick ruin $\frac{1}{4}$ mile eastward of Berry barn, and

Chichester Har-
bor to Selsea Bill.

about the same distance back from the coast; it has a plantation near it. The little village of Circum runs closed down to the coast, and may be known by a row of white houses near the beach belonging to the first station of the coast-guard east of Chichester Harbor. Circum windmill stands at the back of the village, and the first farm-building to the eastward is Bracklesham farm. Thorney coast-guard houses are $2\frac{1}{4}$ miles southeastward of the station at Circum, and $\frac{3}{4}$ mile southeastward of the former is Medmerry barn. Selsea windmill is $\frac{1}{4}$ mile eastward of Medmerry barn, and farther back. The coast-guard houses at Street are between Medmerry barn and Selsea Bill; and immediately behind them stands a remarkable high house at the south end of the village of Selsea, or Street, as it is sometimes called.

Small vessels drawing less than 14 feet may frequently with advantage work to windward in-shore out of the tide in Bracklesham Bay, by closely attending to the lead and taking care not to stand within $\frac{1}{2}$ mile of the shore, as the bank is steep-to, shoaling suddenly from 4 to 2 fathoms. A vessel will be to the eastward of the East Pole when Cackham tower is in one with Chichester spire; and the low-water banks will be cleared when West Wittering church is in line with the cathedral; but to insure clearing the whole of the shoal flat which extends off Chichester Harbor, the coast should not be approached until the cathedral is open eastward of Circum wind-mill; thence to the Streets the bay is safe, with the exception of the Hounds and Medmerry Bank.

The Hounds.

The Hounds is a ledge of rocks extending off Thorney coast-guard houses, which uncovers at spring tides upward of $\frac{1}{2}$ mile off shore. Nelson monument over the west end of Hayling trees leads a mile outside them.

There is a small patch with $2\frac{1}{2}$ fathoms water $\frac{3}{4}$ mile N. W. by W. $\frac{3}{4}$ W. from the Hounds, and about a mile off shore, with 5 fathoms close-to all round it.

Medmerry
Bank.

Medmerry Bank is a shoal of gravel and shells, $\frac{3}{4}$ mile long north and south, and about $\frac{1}{2}$ mile wide, which lies W. S. W. from Medmerry barn, about 2 miles off shore. The shoalest part is near the center, and has 13 feet water with Selsea mill in one with the Luff (a clump of trees on the left shoulder or western part of the high ground to the eastward of Rook's hill,) E. N. E.; and Belmont castle in

line with the watch-house N. by W. $\frac{3}{4}$ W. The northeast end of the large chalk-pit on Portsdown hill in line with the southwest end of Hayling trees leads westward of the bank in 4 fathoms; the watch-house on the eastern side of the entrance to Chichester Harbor N. by W. $\frac{5}{8}$ W. leads eastward of it; and Bracklesham farm in line with Bow hill leaves it to the southward.

A rocky patch called the Bullock, with 28 feet water, lies W. $\frac{3}{4}$ N. nearly 5 miles from Selsea Bill. Ashey Down tower with Bembridge church spire, W. N. W. $\frac{3}{4}$ W., leads close to its southern edge.

Bullock Patch.

A black can-buoy is moored in 7 fathoms $\frac{1}{4}$ mile S. W. of Bullock Patch, with Ashey Down tower open west of Bembridge church, W. N. W. $\frac{1}{4}$ W.; the largest of the easternmost chalk-pits on Portsdown hill in line with the westernmost terrace at Hayling, N. $\frac{1}{2}$ W.; and Nab light-vessel N. W. by W. $\frac{1}{2}$ W. 3 miles. Should the buoy be gone, a bearing of Ashey Down tower or Nab light-vessel will enable a ship to keep outside the patch until the east end of the large chalk-pit on Portsdown hill comes on with the east end of Cumberland fort.

Selsea Bill is a low projection of the coast which shows as a remarkably sharp, low point when seen from east or west.

Selsea Bill.

A life-boat is stationed at Selsea Bill.

Life-boat.

At Selsea Bill it is high water, full and change, at 11h. 45m.; springs rise 16 $\frac{1}{2}$ feet, neaps 12 $\frac{1}{2}$ feet.

Tides.

Numerous banks and rocky patches, known as the Owers, lie off Selsea Bill extending southeastward to a distance of 5 miles, and forming, with the exception of the narrow channel called the Swashway, an almost continuous ledge of dangerous rocks, to the different parts of which distinguishing names have been given.

The Owers.

About $\frac{3}{4}$ mile westward of Selsea Bill, and abreast the High house at Selsea Street, the Streets project from the shore in two parallel ledges which are awash at the lowest tides to the distance of a mile from high-water mark; thence turning suddenly they extend upward of $\frac{3}{4}$ mile to the southward; this part being called the Grounds or Malt Owers, and at its extremity the Dries.

The Streets
&c.

A conical black buoy, marked "Street," is moored in 2 fathoms $\frac{1}{4}$ mile southwestward of the Dries, with the Luff in

line with Selsea Bill, N. E. by E. $\frac{1}{4}$ E.; Chichester spire open east of Selsea coast-guard station, N. N. E. $\frac{1}{2}$ E.; Mixon beacon E. $\frac{3}{4}$ S. 1.4 miles; and Nab light-vessel W. N. W. 7 miles.

Mixon. A considerable mass of rocks called the Mixon lies a mile eastward of the Dries, and about the same distance off Selsea Bill, with which it is connected by a bank of gravel, mud, and weeds, that dries at low-water springs. Between the Mixon and the Dries there is 10 to 14 feet water, shoaling gradually to the shore. Close to the southeastern part of the rock is a hole with upward of 12 fathoms in its deepest part. The eastern end of the Mixon, which is the highest part, covers at one-quarter flood; an iron pillar with a cage 30 feet above high water is erected on it, about 1 mile from Selsea Bill.

Beacon.

Brake or Cross Ledge. The Brake or Cross Ledge is a continuation of that portion of the Streets called the Dries, in a S. W. by W. direction, forming a rocky bar across the western entrance to the Looe, with 10 to 25 feet water over it.

Boulder Bank. A dangerous shoal on the southwestern side of the entrance to the Looe extends a mile to the southwestward, and thence $3\frac{1}{2}$ miles S. E. by E. to the end of the Middle Owers, forming an almost continuous shoal, though different parts of it have distinct names. The portion known as Boulder Bank is composed of gravel, stones, and rock, and has only 2 feet water on its shoalest part, from which the spire of Chichester cathedral is open west of Selsea mill, N. E. by N., and Mixon beacon bears E. N. E. $\frac{1}{2}$ E.

The Pullar buoy is conical, with black and white vertical stripes; it lies in 2 fathoms at the inner or northeast end of Boulder Bank, with Chichester spire nearly in line with the center of the lower grove of trees west of Selsea mill, N. N. E. $\frac{3}{4}$ E.; the Luff and Selsea Bill in line, N. E. by E. $\frac{1}{4}$ E.; and Mixon beacon E. $\frac{1}{2}$ N. 2.1 miles.

The Boulder buoy is conical and black; it lies in 9 fathoms off the southwest angle of Boulder Bank, midway between Nab and Owers light-vessels, with Chichester spire in line with Medmerry barn, N. E. by N.; the eastern end of the trees on Hayling Island on with the west end of the westernmost battery on Portsdown hill, N. by W. $\frac{1}{2}$ W.; Nab light-vessel N. W. $\frac{3}{4}$ W. $6\frac{1}{2}$ miles; and Owers light-vessel S. E. $\frac{3}{4}$ E. $6\frac{1}{2}$ miles.

The Middle Owers, which is the southeastern part of the shoal mentioned above, is composed of large blocks of stone or rock, alternating with patches of coarse gravel, having one dangerous head which nearly dries at low water. Middle Owers.

Between Boulder Bank and Middle Owers are two narrow channels across the shoal which show distinctly when the tide is running, by the ripples near them; and as they carry $3\frac{1}{2}$ to 4 fathoms they might be useful to small vessels, though from their extreme narrowness they can hardly be considered safe. The Mixon beacon in one with the first clump of trees eastward of Pagham church, N. E. $\frac{3}{4}$ N., leads through the western channel in about 20 feet; and the beacon in line with Chichester spire, N. by E. $\frac{3}{4}$ E., leads through the eastern channel, which has rather less water.

The Middle buoy is a checkered black and white can-buoy in 5 fathoms on the northeast side of the Middle Owers, just abreast its shoalest part, with Chichester spire twice its apparent length east of Selsea Corner, N. by E. $\frac{1}{4}$ E.; the Luff in line with Felpham church, N. E. $\frac{1}{4}$ E.; and Owers light-vessel S. E. $\frac{3}{4}$ E. 3.3 miles.

The Outer Owers is the most dangerous of the shoals off Selsea Bill, and its off-lying position renders it one of the most formidable dangers in the English Channel during the strong tides and heavy seas which accompany southerly gales. Its shape is irregular, and its limits difficult to define, but it occupies an extent of not less than 2 miles N. by E. and S. by W., and the same distance E. and W. Over a considerable extent of the Outer Owers there is not more than 12 feet water, and only 2 or 3 feet on the part called the Shoal of the Lead, from which Chichester spire appears half way between Pagham church and a single tree near the coast, a short distance eastward of the church, N. $\frac{1}{4}$ E.; and Mixon beacon bears N. N. W. $\frac{3}{4}$ W. Outer Owers.

The Elbow, which is the southern or outer prong of the Outer Owers, lies S. S. W. nearly $\frac{3}{4}$ mile from the Shoal of the Lead. There are no good marks to define its position, and great care must be taken in approaching it, as it is steep-to, with 30 fathoms within a hundred yards of its extremity.

An extensive mass of rocks with only 6 feet water, called Eastborough Head, lies northward of the main body of the Outer Owers, from which it is separated by a narrow gut of 4 fathoms, not available as a channel. Eastborough Head.

West Head. West Head is a small detached reef which may be considered the western extremity of Eastborough Head.

East Bank. East Bank is an accumulation of gravel and sand with 19 feet water, lying eastward of Eastborough Head. Pagham watch-house in line with Chichester spire, N., leads between them in 26 feet, but strangers should not attempt to pass through.

A conical buoy, checkered black and white, with a staff and cage, and marked East Boro Head, is moored in $4\frac{1}{2}$ fathoms, a short distance eastward of the shoalest part of East Bank, with the turret of Pagham church in line with a grove of yew trees called Fountingden Wood, N. by W., Selsea mill open north of the white boat-house on Selsea green, N. W. $\frac{1}{4}$ W.; Owers light-vessel S. S. W. $\frac{1}{2}$ W. 2.7 miles; and Mixon beacon N. W. by W. 4.4 miles.

Light-vessel. The Owers light-vessel, moored in 19 fathoms, $\frac{3}{4}$ mile S. S. E. from the Elbow or southern extremity of the Outer Owers, exhibits at an elevation of 38 feet above the sea a fixed bright light which should be visible in clear weather from a distance of 10 miles. A gong is sounded in foggy weather, and a gun fired if a vessel is seen standing into danger. The light-vessel has one mast, with a red ball at the mast-head, and is painted red, with the name "Owers" on her sides. From her position the east end of the plantation on Bow Hill is in line with Pagham church N.; Mixon beacon bears N. N. W. $\frac{1}{4}$ W. $5\frac{1}{2}$ miles; and Nab light-vessel N. W. $\frac{3}{4}$ W. 12.8 miles.

Hooe Bank. Outside the Owers, from Boulder Bank to a mile eastward of the Elbow, is an extensive field of rock, with 7 to $9\frac{1}{2}$ fathoms water over it, which presents to the mariner a most valuable warning of his approach to the Owers. Abreast Boulder Bank it runs off about 3 miles to the S. S. W., having 12 to 17 fathoms water inside it; but the deep water does not continue farther westward than the west end of Boulder Bank, its western limit being pretty accurately defined by the mark for clearing Cross Ledge. To the eastward this bank narrows considerably as the Outer Owers is approached, forming a sort of tail to the main body, partially separated from it by a narrow swash of rather deeper water; this part, called Hooe Bank, is 3 miles long, E. S. E. and W. N. W., and about $\frac{1}{4}$ mile broad, the outer part being nearly $1\frac{1}{2}$ miles from the Elbow. The least water on Hooe

Bank is between 7 and 8 fathoms, with the Mixon beacon in line with Street watch-house, and as little water will occasionally be found on the western or large bank; but the soundings within the Hooe range from 13 to 30 fathoms, the greater depth being near the southwestern edge of the Elbow. The position of the bank is clearly shown by the overfall of the tide, which occasions a heavy broken sea when running to windward in blowing weather.

Two channels cross the Owers, the Swashway and the Looe Stream. The Swashway.

The former is between the Middle Owers and the west head of the Outer Owers, and is 0.8 mile wide between the 3-fathom lines, with 5 to 7 fathoms water. As regards space and depth, it is available for ships of moderate draught, but it saves little in distance, and a ship taking it may possibly become entangled among the shoal flats in the Park. Kinnaird house in one with Clarence hotel at Bognor, N. E. $\frac{1}{4}$ N., leads through on the western side of the channel; Mixon beacon on with the coast-guard house at Selsea Street, N. by W., leads through on the eastern side; and Selsea Corner in one with the White way on Bow Hill, N. $\frac{3}{4}$ E., leads through in mid-channel. These are safe marks, but the objects are distant, and not easily recognized by strangers. After passing through from the southward, the Middle Owers buoy should be brought to bear W. S. W. $\frac{1}{4}$ W., and an opposite course steered to pass between the inner end of the Outer Owers and the shoal patches to the northward.

The Looe Stream, lying as it does within the whole line of dangers, barred at its western entrance by turbulent overfalls, and having in many parts not more than 16 feet at low water, is only adapted for vessels of light draught, except under the most favorable circumstances. Great caution is requisite not to be caught in it at night, and it should not be attempted except with a strong breeze and time enough to be certain of getting through in daylight, nor should a sailing-vessel attempt it against an adverse tide. The Looe Stream.

Coming from the westward, take care not to get too close in-shore, and as Cross Ledge is approached do not bring the Mixon beacon to the northward of the Dries buoy, or else keep Nelson Monument well open of Hayling trees to avoid the Streets, and, as the eastern stream sets strongly

toward Boulder Bank, some caution is necessary in light winds. When crossing the ledge give the Dries buoy a sufficient berth, for there is only 11 feet water $\frac{1}{4}$ mile south of it; the Pullar buoy may be passed close-to, always leaving it to the southward. If the Isle of Wight is tolerably clear, Little See-me-not, just showing south of Culver Cliff, W. N. W. $\frac{1}{2}$ W., is an excellent mark for leading over Cross Ledge and through the Looe in 14 feet water. The Pullar buoy on with Culver Cliff is a good mark through the Looe. When Mixon beacon bears N. or N. by W., the vessel may be considered through the channel, and entering that part of Pagham Bay called the Park.

Small vessels under favorable circumstances frequently work through the Looe in fine weather. In standing to the southward do not bring the Middle buoy to bear more easterly than S. E. by E., and in shooting over Cross Ledge contrive to pass near the Pullar buoy. When eastward of the Middle buoy do not attempt to pass it to the southward until Kinnaird house is in one with the Clarence hotel at Bognor, N. E. $\frac{1}{4}$ N., which is one of the Swashway marks. On the north side of the channel do not stand so far over as to get between the Dries buoy and the Mixon, for the rocks are dangerous; the buoy should not be brought to the westward of N. W. Abreast the beacon the rocks are steep-to, but it will be best on account of the strong eddies to give it a moderate berth. To the eastward of the Mixon stand no farther northward than to have it bearing W., which will insure 15 feet at low water.

Tides.

At Selsea Bill it is high water, full and change, at 11h. 45m.; springs rise $16\frac{1}{2}$ feet, neaps $12\frac{1}{2}$ feet. At the western entrance of the Looe, near Pullar buoy, the eastern stream makes at 3h. 45m., and the western stream at 10h. 0m, and they set S. E. and N. W. Between 2 and 3 miles outside Boulder Bank the stream turns about an hour later, the eastern stream running E. S. E. and the western stream W.; and between Boulder Bank and Middle Owers the streams run in the same directions. At the eastern entrance of the Looe, near Eastborough Head, the eastern stream makes at 4h. 30m., and sets E. N. E. $\frac{1}{2}$ E., and the western stream at 9h. 50m., setting W. Off the west end of Hooe Bank, the eastern stream makes at 4h. 35m., setting E. S. E., and the western stream at 10h. 30m., setting W. $\frac{3}{4}$ N.

The large bight to the eastward of Selsea Bill is called Pagham Bay, at the bottom of which is Pagham Harbor. The shore from the Bill to Pagham is a low shingle beach, and must be approached with great caution by vessels working to windward, as the flats extend off at least 2 miles, where the depth is less than 3 fathoms. Off the Bill these flats project southward toward Eastborough Head, and effectually bar the eastern entrance of the Looe to vessels of great draught, at low water, but ordinary attention to the lead will give sufficient warning of their proximity. No landing can be effected at low water to the westward of Pagham Harbor, except near Selsea Bill.

Pagham Bay.

Pagham Harbor is completely choked up by shifting banks. Selsea church stands on the western side of the entrance and Pagham church on the eastern side; the latter has the taller spire. Sidlesham water-mill, easily recognized from the bay, stands with its face to the southward at the head of the harbor. Eastward of Pagham the coast becomes a low earthy bank, rapidly crumbling away by the action of the sea, with a flat and highly-cultivated country at the back. Pagham coast-guard houses stand a short distance eastward of the harbor. Nye Timber windmill may also be seen a little north of the watch-house.

It is high water, full and change, near the entrance of Pagham Harbor, at 11h. 30m.; springs rise 16½ feet, neaps 12½ feet.

Tides.

The anchorage in Pagham Bay, between the Owers and the coast, called the Park, is well sheltered from westerly and southwesterly winds, but is very unsafe when the wind is eastward of south. The holding ground is excellent, being stiff clay under a thin crust of gravel; but the Park cannot be recommended as a refuge for large vessels, owing to the frequent and sudden shifts of wind, and the astonishing rapidity with which the sea gets up.

The Park.

Small vessels anchor with Mixon beacon bearing W. S. W., and Pagham watch-house on with Chichester spire, in about 3 fathoms at low water, but vessels of great draught should anchor farther out and more to the eastward, with the spire to the westward of Bow Hill and Mixon beacon W. by N., both for greater depth of water and increased facility for getting away from the coast, if surprised by a shift of

wind. The nearer the Mixon is approached the stronger are the tides.

Tides. The eastern stream makes in the Park at 4h. 5m., and sets E., the western stream makes at 9h. 50m., and sets W. for 3 hours; between the 3d and 4th hours it slackens and runs from W. S. W. to S. W. by S., gradually turning to the southward until the eastern stream makes; the velocity never exceeds $1\frac{1}{2}$ knots.

Bognor. Bognor is a fashionable watering-place, conspicuous from the sea in every direction. The white mill of Felpham stands close to the shore about $\frac{1}{2}$ mile eastward of the town, and about the same distance back of the mill is the venerable little church of Felpham, which, having no spire, is easily distinguished from Bersted church, about a mile northwest of it.

Tides. It is high water at Bognor, full and change, at 11h. 30m.; springs rise $17\frac{1}{4}$ feet, neaps $14\frac{1}{4}$ feet.

Bognor Rocks. A dangerous ledge extends in a southeast direction at least $1\frac{3}{4}$ miles from the shore a little westward of Bognor; it dries some time before low water in large detached rocks, bold on their sea-face. Bognor Spit, the outer end of the ledge, is a mile off shore, and dries at 5 hours' ebb, with 13 to 17 feet water on its northeast side. From it Pagham church and watch-house are in line, N. W. by W. $\frac{3}{4}$ W.; and Felpham church is open eastward of the two mills. Pagham watch-house open north of Pagham church, N. W. by W. $\frac{1}{4}$ W., leads $\frac{1}{4}$ mile south of the ledge; Felpham white mill in one with a grove east of Rooks hill, N., leads eastward of it; and Middleton church spire on with the turret of Arundel church (white) leads southeast of it.

Anchorage. There is an anchorage in-shore on the northeast side of Bognor Rocks, which may be used by small vessels unable to get as far as the Park during westerly winds; but there is no outlet with southeast winds, which bring in a heavy sea. After rounding Bognor Spit steer for the shore to the westward of Felpham white mill, and anchor when Pagham church opens north of the coast guard-houses, or when Bognor church tower is seen just westward of a large white house near the beach, and Arundel church tower opens westward of a large clump of trees.

Shelly Rocks. The Shelly Rocks lie $1\frac{3}{4}$ miles S. S. E. of Felpham mills, and have only 4 to 6 feet water over them in detached

patches. From the outer or southeast patch, Middleton church spire is in line with the east end of a long barn, N. N. E. $\frac{1}{4}$ E., and the middle chalk-pit on Highdown hill is on with the western of the two Rustington mills.

There is a conical black buoy in 4 fathoms on the south-east side of the rocks, from which Arundel church tower is on with the coast-guard house at Elmer, N. E. $\frac{1}{4}$ N.; and Chichester spire is in line with Felpham station-house, N. W. by N. The square black mill at Felpham, just open west of the circular white one, N. by W. $\frac{1}{2}$ W., westward of the Shelly Rocks in 3 fathoms, and the mills in line with Rooks hill, N. $\frac{3}{4}$ W., lead between the rocks and Bognor Spit to the anchorage on the northeast side of Bognor Rocks.

Middleton Ledge projects from the shore about midway between Felpham mills and Middleton church, extending to the S. S. E. There is 4 to 6 feet water over the ledge, and 11 feet between it and Shelly Rocks, but no vessel drawing more than 9 feet should pass inside Shelly or Winter Rocks at low water. Middleton Ledge.

Winter Knoll is a small bank of chalk, with only 8 feet water on it, lying off the coast-guard station at Elmer, about S. W. by W. $2\frac{1}{2}$ miles from Little Hampton light-house. From the shoalest spot Arundel church is in line with the middle of the eastern of two gaps in the Park trees, N. E. by N.; and Cisebury hill appears over the top of Highdown hill, E. N. E. $\frac{3}{4}$ E. Winter Knoll.

A black can-buoy is placed in 3 fathoms off the south side of this shoal, with Dome house at Bognor its width open north of the black mill at Felpham, N. W. $\frac{1}{4}$ W.; and Little Hampton pier light-house N. E. $\frac{1}{2}$ E. 2.4 miles distant. Salvington mill, in line with the chalk-pit on Highdown hill, E. N. E. $\frac{1}{2}$ E., leads south of the knoll.

Kingmere Rocks lie $4\frac{1}{2}$ miles off shore, S. S. W. from Highdown hill and Preston church, and have $4\frac{1}{2}$ to $5\frac{1}{2}$ fathoms water on them. They cover a space 2 miles long, N. W. by W. and S. E. by E., and are very narrow; between them and the flats which extend off shore the depth is $5\frac{1}{2}$ and 6 fathoms, with occasional patches of $3\frac{3}{4}$ fathoms. Kingmere Rocks.

Chanctonbury grove open westward of Salvington mill, or Goring church (with a black spire) N. E., lead over their western end in 29 feet water; Nayarino mills, between Lancing grove and mill, N. E. by E., lead over their east-

ern end in 33 feet; and Chichester church spire over the the north part of Felpham trees lead over their northwestern part in 29 feet, and southward of their eastern end in $7\frac{1}{2}$ fathoms.

Little Hamp-
ton.

Little Hampton is at the mouth of the river Arun, about 5 miles eastward of Bognor. The entrance is between two piers, 125 feet apart, the western one projecting 200 yards beyond the other, to prevent the sand from washing in. In continuation of the eastern pier is a low dicker-work, which is carried out nearly to low-water mark above the level of the sands, to scour the entrance and prevent the formation of a bar. There is a row of warping-posts 20 feet eastward of the dicker-work; the three outer posts are outside the low work, the termination of which on both sides is marked by a bush beacon.

There is 16 feet in the fairway off the warping-post, at high-water springs; 15 feet abreast the bush beacon on the end of the low western work; 17 feet between the piers; 16 feet abreast the mill, and a general depth of 18 to 16 feet up to the ferry at the northwestern part of the town of Little Hampton. A vessel drawing 13 or 14 feet water can proceed up to Arundel, there being a towing-path on the port hand and several berthing-piles should she be obliged to stop for tide. At the town of Little Hampton, about $\frac{3}{4}$ mile within the entrance, there is a patent slip, 400 feet long, capable of taking out a vessel of 400 tons and 10 feet draught.

Lights.

On the north end of the east pier is a fixed red light, 30 feet above high water, which should be visible in clear weather from a distance of 7 miles.

A bright light on the south end of the east pier indicates a depth of 10 feet between the piers; a green light, 11 feet; a red light, 12 feet; a red and a bright light in a vertical line, 13 feet; two bright lights, 14 feet; and a bright and a green light, 15 feet. These lights in one with the fixed red light, N., lead to the entrance. They are extinguished at high water.

Tides.

It is high water at Little Hampton, full and change, at 11h. 36m.; springs rise 16 feet, neaps $11\frac{1}{2}$ feet. The general depths over the bar are $14\frac{1}{2}$ to $15\frac{1}{2}$ feet at high-water springs, and $9\frac{1}{2}$ to $11\frac{1}{2}$ feet at neaps. At Arundel it is high water at 12h. 25m.

The stream in the river depends on circumstances ; after heavy rains there is a constant downward current. The flood runs with great strength until an hour after high water, but immediately outside the eastern pier-head it sets strongly to the westward from half flood to half ebb, which must receive attention in going in or out in order to avoid the western jetty-work. At the north end of the east pier is a white mast, on which signals showing the depth in feet at the entrance are displayed. These signals are the same as those shown at New Shoreham. A torch-light is exhibited when the harbor is inaccessible.

Vessels drawing less than 10 feet will find good anchorage in the 2-fathom hole off Little Hampton, with the outer warping-post in one with the mill near the harbor, N. $\frac{3}{4}$ E., and Cisebury Hill opening southward of the crest of Highdown Hill ; or a mile from the piers in 13 feet water, chalk and gravel, with Salvington mill in line with the chalk-pit of Highdown. If drawing 17 feet, anchor with the entrance open about $1\frac{1}{2}$ miles distant, and Chanctonbury grove over the western chalk-pit on Highdown, in 19 or 20 feet water, over chalk, stones, and gravel. There is a position farther westward much approved of by the pilots, with Little-Hampton church in line with the coast-guard houses east of the harbor mill, or the mill open west of the light-house, and the Winter buoy W. by N., 1 mile distant. Should it be necessary to anchor before going into the river it would be advisable, with easterly winds, to anchor off Rustington mills, as the stream will set to the westward by the time there is water to enter.

Anchorage.

Approach with the outer warping-post in one with the light-house, bearing N., and keep about a ship's length westward of the outer posts, taking care to be to the westward of the bush on the end of the low work and to make allowance for the stream, which sets about $2\frac{1}{2}$ knots to the westward at half tide and about 6 knots up the harbor between the piers. After passing Mussel row the tide slackens, and when near the berthing place it is customary to let go the anchor and warp into a berth. Pilots provided with fine boats are always in attendance.

Directions.

A life-boat is stationed at Worthing, about 6 miles east of Little Hampton.

Life-boat.

The Grass Banks, which extend along the coast off Worth-

Grass Banks

ing, are of chalk and gravel, on which a great quantity of long grass grows; they have as little as 9 feet water $1\frac{1}{2}$ miles from shore. Their most projecting part, called the Elbow, bears S. S. E. from Navarino mills, and S. S. W. from Lancing grove, and their east end is about a mile westward of the black coast-guard buildings at Shoreham.

When sailing along shore from the eastward keep the lead going, and do not stand nearer the Elbow than to have Portslade mill coming on with Shoreham piers. The mill on with the low light-house at Shoreham leads outside it in 12 feet at low water. When Lancing grove is in one with the coast guard-houses, N. N. E., a course more to the northward may be kept; but when working to windward the lead is the best guide.

Chanctonbury
Ring.

Five miles N. N. E. from Worthing is Chanctonbury Ring, a large thick circular grove of trees 964 feet above the sea, which is frequently the first object seen on making the land.

New Shoreham.

The entrance of New Shoreham Harbor, at the mouth of the river Adur, is between two piers 176 feet apart, with a depth of 21 feet at high-water springs, and 15 feet at high-water neaps. Within these piers a middle pier is built out from the shore, dividing the harbor into two parts called the eastern and western arms, the western arm being the river Adur. There is a patent slip in each, that in the western arm being capable of taking out a vessel of 600 or 700 tons; the other is smaller. The western arm has $20\frac{1}{2}$ feet in it at high-water springs, and 15 feet at high-water neaps, and vessels drawing not more than 7 feet can lie afloat at low-water springs. The bed of the river between the wharves and the town is uneven and hard; at the town the bed is 5 feet above the level of low-water ordinary springs. At the custom-house quay there is $11\frac{1}{2}$ feet at high-water springs. The eastern arm, between the middle pier and the entrance lock of the floating canal, has a depth of $17\frac{1}{2}$ feet at high-water springs, and 12 feet at neaps. The canal is $1\frac{1}{2}$ miles long, and has 16 feet at high-water springs, and 11 feet at neaps. The lock is 175 feet long, 33 feet wide, and the depth over the sills is $21\frac{1}{2}$ feet at high and 5 feet at low-water springs; and 16 feet at high and 8 feet at low-water neaps. Vessels drawing 15 feet can lie afloat inside the lock.

A horn or breakwater is constructed near the west side

of the western pier, which vessels entering must be careful not to mistake for the western pier-head.

The coast about Shoreham is low, showing the deep valley of the Adur between Shoreham and Lancing; but Lancing circular grove, Lancing white mill, the town of Shoreham, the high coke-chimney near the harbor, and the mills of Copperas and Portslade are easily recognized.

On the shore abreast the piers is a gray stone tower 38 feet high, from which is exhibited at an elevation of 42 feet above high water a fixed light which should be visible in clear weather from a distance of 10 miles. Lights.

At the end of the middle pier, 250 yards S. S. W. of the light-house, is a white wooden building 5 feet high, from which at an elevation of 23 feet above high water a fixed light is exhibited during the time a vessel drawing 11 feet may safely enter the harbor. During high-water slack a red shade is put over this light. There is a flag-staff on the building, on which a red flag is hoisted in the day-time, while a vessel drawing 11 feet can enter; at high-water slack the flag is hauled half-staff down.

Near the low light-house on the middle pier is a flag-staff with a yard on which the following signals, which are identical with those shown at Little Hampton, are made with black balls two feet in diameter, and a blue and white pennant. Signals.

SIGNALS.	SIGNIFICATION.
A single ball at mast-head.....	General answer or acknowledgment.
Two balls at mast-head.....	There is 8 feet water on bar, with flowing tide.
Three balls at mast-head.....	There is 9 feet water on bar, with flowing tide.
One ball at outer yard-arm.....	There is 10 feet water on bar, with flowing tide.
Two balls at outer yard-arm.....	There is 11 feet water on bar, with flowing tide.
Three balls at outer yard-arm.....	There is 12 feet water on bar, with flowing tide.
One ball at inner yard-arm.....	There is 13 feet water on bar, with flowing tide.
Two balls at inner yard-arm.....	There is 14 feet water on bar, with flowing tide.
Three balls at inner yard-arm.....	There is 15 feet water on bar, with flowing tide.
A single ball at each yard-arm.....	There is 16 feet water on bar, with flowing tide.
A pennant at mast-head.....	It is now slack tide.

SIGNALS.	SIGNIFICATION.
A pennant and one ball under at mast-head.	Sixteen feet on bar with an ebbing tide.
A pennant and two balls under at mast-head.	Fifteen feet on bar with an ebbing tide.
A pennant at mast-head and one ball at outer yard-arm.	Fourteen feet on bar with an ebbing tide.
A pennant and two balls at outer yard-arm.	Thirteen feet on bar with an ebbing tide.
A pennant and three balls at outer yard-arm.	Twelve feet on bar with an ebbing tide.
A pennant and one ball at inner yard-arm.	Eleven feet on bar with an ebbing tide.
A pennant and two balls at inner yard-arm.	Ten feet on bar with an ebbing tide.
A pennant and three balls at inner yard-arm.	Nine feet on bar with an ebbing tide.
A pennant at outer yard-arm	Eight feet on bar with an ebbing tide.
A pennant and one ball under at outer yard-arm.	There is not water enough on bar.
A pennant and two balls under at outer yard-arm.	Keep eastward.
A pennant between two balls at outer yard-arm.	Keep westward.
A pennant under one ball at outer yard-arm.	The signal cannot be made out; the flag is foul or hid by upper sails.
A pennant under two balls at outer yard-arm.	The depth of water will be shown at every foot rise or fall.
A pennant at inner yard-arm	Assistance will be sent immediately.
A pennant with one ball under at inner yard-arm.	Pilots cannot get to sea.
A pennant with two balls under at inner yard-arm.	Pilots will be sent when a boat can pass the bar.
One ball with pennant under at inner yard-arm.	Pilots are all engaged, but one will be sent as soon as possible.
Two balls with pennant under at inner yard-arm.	The owner wishes his vessel to bear up for shelter.
Two balls at outer and one ball at inner yard-arm.	The owner does not wish his vessel to risk the bar.
One ball at outer and two balls at inner yard-arm.	Pilots will be on the pier; if the vessel attempts the bar the depth of water will be shown.
Two balls at mast-head and one ball at outer yard-arm.	It appears a vessel might stem the tide.
Two balls at mast-head, and one ball at inner yard-arm.	The tide runs so strong that a vessel may not be able to stem the tide.
One ball at mast-head, with pennant under.	The tide is ebbing.
Two balls at mast-head, with pennant under.	The tide is flowing.

A life-boat is stationed at New Shoreham.

Life-boat.

The magnetic variation was $20^{\circ} 23'$ W. at Shoreham Harbor in 1870, diminishing at the rate of $7'$ annually.

Magnetic variation.

It is high water, full and change, in New Shoreham Harbor at 11h. 34m.; springs rise 18 feet, neaps $13\frac{1}{2}$ feet. The stream runs with great force between the piers on both tides, often as much as 6 knots; on the flood it is split by the middle pier, and its force diminished in each arm.

Tides.

The Church Rocks lie $\frac{1}{2}$ mile westward of the black coast-guard buildings at Shoreham, or two-thirds of the way from them toward the groynes on the beach, and $\frac{1}{3}$ mile off shore, with the cement chimney in one with the roof of Shoreham church, and Lancing mill over the two easternmost groynes on the beach. There is 3 feet water over them, but they are said to have been seen dry. Fisher's gate mill (circular and gray) just open of Shoreham Harbor piers, E. $\frac{1}{2}$ S., leads southward of them in 14 feet.

Church Rocks.

A cluster of chalk rocks, called the Jenny Ground, with 5 to 7 feet water, extends $\frac{1}{2}$ mile off shore abreast the square white mill of Copperas, which stands on the low cliffs near the eastern arm of Shoreham Harbor. From the outer part, in 7 feet water, Copperas and Portslade mills are in one, N. N. E., and Shoreham church is shut in with the piers. Shoreham church on with Lancing grove, and open south of the white pier heads, N. W., or the spire of the church in the eastern part of Brighton shut in with the old chain-pier, E. N. E. $\frac{1}{4}$ E., will lead outside the Jenny Ground.

Jenny Ground.

A vessel may anchor in any convenient depth off New Shoreham, from 16 feet at the distance of $\frac{1}{3}$ mile to 24 feet 1 mile off shore, over sand and gravel with patches of chalk; or westward of the Jenny Ground with Shoreham church on with Lancing grove, in 3 fathoms, sand, shells, and mud. Should it be necessary to wait for sufficient water to enter the harbor, anchor off the black coast-guard buildings, with Shoreham church bearing N., and Portslade mill between the low light-house and the pier-heads, in $3\frac{1}{2}$ fathoms. This position is sheltered from westerly winds by the shallows off Worthing, and has an easy stream on the flood.

Anchorage.

After passing Worthing, when bound to New Shoreham from the westward, a deep valley will open, on the east side of which is Shoreham church; it has a square tower,

Directions

its roof appears white, and it stands about a mile westward of the piers.

When coming from the eastward the Jenny Ground will be avoided by keeping New Shoreham church open south of the pier-heads, N. W.; at night do not approach the shore within the depth of 5 fathoms, at low water, until the high light bears N. N. W. A vessel working to windward between Newhaven and Shoreham will find in-shore a stream setting to the westward nearly 2 hours before high water, and by making short tacks will get to the westward before the offing stream has made down Channel.

As the tide is strong at the entrance, the best time to enter is at high-water slack. The two light-houses in one, N. N. E., lead midway between the outer pier-heads, but either by night or day be careful to allow for the stream just mentioned setting to the westward. When inside the outer piers borrow to whichever side the vessel is bound to, to avoid being set by the stream against the middle pier, where some serious accidents have occurred. In the western arm buoys are moored abreast the wharves, on the top edge of a steep bank, and it is customary to make fast to a buoy or run the vessel's fore foot on the bank, or drop the anchor and let the flood-stream swing her stern round, and then warp into a berth.

Brighton.

Brighton is a fashionable watering-place, about 4 miles southeast of Shoreham, which had in 1861 a population of over 87,000. An almost continuous line of handsome buildings fronting the sea for a distance of 3 miles renders it a conspicuous object from the offing. A fine pier, 140 feet broad at the head, extends 1,115 feet into the sea, and a mile eastward of it is the old chain-pier, which extends 1,100 feet from high-water mark.

Lights.

There is a fixed red light at the pier-head which should be visible from a distance of 5 miles.

On the chain-pier head is a light-house 22 feet high, from which a fixed green light is exhibited at an elevation of 35 feet above high water, which should be visible from a distance of 10 miles.

Life-boat.

A life-boat is stationed at Brighton.

Tides.

It is high water at Brighton, full and change, at 11h. 15m.; springs rise 19½ feet, neaps 16 feet. The stream in-shore turns to the westward about 2 hours before high water

Black Rock Ledge extends $\frac{1}{4}$ mile from the cliffs off the eastern part of the town of Brighton, abreast the Black Rock coast-guard station. The ground is shoal for $\frac{1}{4}$ mile outside the ledge, which must be approached with caution when the tide is low. Beachy Head light-house open of Seaford cliff leads outside it in 3 fathoms. When the tide flows over the ledge it is difficult to estimate the distance off shore; but the pier-end shut in with the western houses in Brighton will clear the dry part of the ledge about a cable-length.

From Brighton to Newhaven the coast is composed of chalk cliffs, varying from 30 to 170 feet in height, the summits of which are clothed with verdure. The village of Rottingdean lies in one of the valleys about $1\frac{1}{4}$ miles S. E. by E. of the eastern part of Brighton; and on the western side of the downs, adjoining Rottingdean, is a large, black mill, which is conspicuous from seaward. Burrow Head, the eastern cliff of this range, is about 190 feet high, and has a flag-staff upon it; the upper part is earth and the lower part chalk, but the wash from the earthy part gives its face a rusty appearance. All this part of the coast is studded with chalk rocks in detached patches on a sandy strand, but the depths alongshore are regular. Beachy Head light just shut in by Seaford cliff leads outside all these patches in 8 to 14 feet water, and kept a quarter point open is a good working mark; the best guide, however, is the lead.

The Fricker Rocks lie off Burrow Head, nearly $1\frac{1}{2}$ cable-lengths from the cliffs, and $\frac{1}{4}$ mile from the entrance of Newhaven Harbor; they dry 10 feet at low water. These and the shallows off Newhaven are cleared in 16 feet water by keeping Blatchington church spire over the low cliffs between the Buckle inn and the long row of white coast-guard buildings near the battery.

Newhaven Harbor, at the mouth of the river Ouse, just eastward of Burrow Head, is the best tidal harbor in the English Channel east of the Isle of Wight. The piers at the entrance are 150 feet apart, and extend in a southerly direction across the beach. A high groyne, or breakwater, runs out in a S. W. by S. direction a short distance westward of the west pier to prevent the formation of a shifting bar; it also splits the sea in strong westerly gales, so that

vessels enter easily between the piers. There are capstans on each pier, and a red warping-buoy is moored S. by E. $\frac{1}{2}$ cable-length from the east pier-head. There is 4 feet water in the entrance at low-water springs, and 6 to 8 feet at low-water neaps. On the western shore a stone embankment extends from the pier as far up as the watch-house opposite the railway hotel. From the watch-house to the bridge are berthing-piles, alongside which vessels ground on soft mud. Near the hotel is a good wharf from which steamers run to Dieppe and Jersey. There is also a gridiron capable of taking a vessel of 600 tons and 200 feet long.

At the town of Newhaven, nearly a mile above the entrance of the harbor, is a swing bridge, with a clear opening of 36 feet. Above the bridge is a yard for building and repairing vessels. The river is navigable for small vessels as far as Lewes.

Lights.

Near the middle of the western pier is a wooden light-house 33 feet high, from which is exhibited, at an elevation of 30 feet above high water, a fixed light, which should be visible from a distance of 10 miles.

On the same pier, 50 yards S. $\frac{1}{2}$ E. from the above, is a second wooden light-house, displaying at an elevation of 17 feet a light which shows red when there is between 10 and 13 feet water in the entrance, and bright when the depth exceeds 13 feet.

On the eastern pier abreast the above light-houses is an octagonal wooden building about 14 feet high, painted stone color, from which a fixed green light is shown at an elevation of 18 feet, visible 3 miles.

Tidal signals.

There is a flag-staff on the western pier on which signals indicating the depth of water at the entrance are displayed. For 8 to 10 feet, one black ball is hoisted on the flag-staff; for 10 to 13 feet, two black balls; and for greater depth a red flag is displayed.

Life-boat.

A life-boat is stationed at Newhaven.

Magnetic variation.

The magnetic variation was $20^{\circ} 13'$ W. at Newhaven, in 1870, diminishing at the rate of $7'$ annually.

Tides.

It is high water at Newhaven, full and change, at 11h. 51m.; springs rise 20 feet, neaps 15 feet. About $1\frac{1}{2}$ hours before high water the stream begins to set to the westward close in shore; but is so weak across the entrance of the harbor that it is of no consequence except to a sailing-vessel

with a light wind. Between the piers the stream runs about $2\frac{1}{2}$ knots on both tides, diminishing in force as the harbor widens. On the strength of the ebb it is not easy to enter.

When coming from Beachy Head toward Newhaven, observe the rocks off Crowlink, (on the Seven Sisters,) and if they are awash or covered it will indicate a depth greater than 10 feet at the entrance of the harbor. Run toward Burrow Head, and when nearing the piers bring them to bear N, with the harbor open, and passing westward of the red buoy steer between the piers. When far enough up, anchor, or run out a warp to the berthing-piles or stage, and drop into a berth.

Directions.

At night the gas-lights at Brighton greatly assist in making the entrance. Observe the depth shown by the lights, and run in with them in one, N. $\frac{1}{2}$ W., until well up to the western pier, when open the harbor and proceed up between the piers.

A low beach extends from Newhaven Harbor to Seaford Head. A short distance eastward of the former is Catt's tide-mill, a large yellow building. The village of Seaford, which may be recognized by the square tower of its church, the spire of Blatchington church, a little farther inland, and the martello tower on the beach near the low northwest point of Seaford Head, are conspicuous objects. The high land at the back of Seaford and Newhaven is a continuation from Beachy Head of the range of hills called the South Downs.

Newhaven to
Seaford Head.

Between Shoreham and Beachy Head the soundings gradually decrease from the offing toward the land, and a vessel may anchor anywhere in 2 to 9 fathoms with off-shore winds; but the anchorage generally resorted to is Seaford Road between Catt's tide-mill and the martello tower. The best anchorage is between the tower and Blatchington battery, with Beachy Head light-house just shut in by the cliffs, in about 7 fathoms, over sand, shells, and mud. In this position Beachy Head affords shelter with the wind as far southerly as E. S. E., and it is therefore superior to the West Bay of Dungeness.

Seaford Road.

Seaford Head is 270 feet high, and has a rusty white appearance, with a large green patch on its face near the top. It is often mistaken for Beachy Head by vessels coming up

Seaford Head.

the Channel, when within 4 or 5 miles of the land, but the latter has a clean white face and is surmounted by a small building. Some straggling chalk-rocks called the Henston, with 2 to 4 feet water on them, lie $\frac{1}{4}$ mile off the low northwest end of Seaford Head, with Blatchington church-spire and mill just open eastward of the martello tower on Seaford Beach. Newhaven mill on with the pier-heads, or Crowlink coast-guard houses open of the southeast cliff of Seaford Head, leads southward of them in $3\frac{1}{2}$ fathoms.

Seaford Head
to Beachy Head.

To the southeast of Seaford Head is the valley of Cuckmere, through which a small stream runs; and between this and Beachy Head is a range of undulating cliffs, called the Seven Sisters, which are distinctive features in the appearance of Beachy Head when seen from the westward. Several caverns have been cut in the cliffs, with steps leading to them, in which those wrecked on this part of the coast may take refuge.

CHAPTER VII.

BEACHY HEAD TO NORTH FORELAND.

Beachy Head is a bold headland 550 feet high. When seen from the westward it is remarkable from the uniform convexity in the profile of its seven white cliffs, called the Seven Sisters; when 15 miles distant in an E. S. E. direction it makes like an island, the left side being chalk cliffs, with a house on it, and the middle and right side are covered with verdure, terminating in the bluff of the South Downs.

Beachy Head.

A circular white light-house 47 feet high stands on Belle-tout cliff, the second cliff westward of Beachy Head, 242 feet above high water. It exhibits at an elevation of 285 feet a revolving light alternately visible 15 seconds, and eclipsed 1 minute 45 seconds, which should be visible in clear weather from a distance of 23 miles. Coming from the eastward it opens when bearing N. W. $\frac{3}{4}$ W., and kept on that bearing leads $1\frac{1}{4}$ miles outside the southern head of the Royal Sovereign Shoals.

Light-house.

It is high water at Beachy Head, full and change, at 11h. 20m.; springs rise 20 feet, neaps 15 feet. The stream in the offing begins to run to the eastward at low water, and continues until high water, when it turns to the westward.

Tides.

The Royal Sovereign Shoals are a number of rocky banks lying directly in the track of vessels between Beachy Head and Dungeness. The principal ones are the Royal Sovereign, Southern Head, Long Shoal, Horse of Willingdon, and Elphick Tree. There are strong rippings over them during spring tides, and in bad weather the sea breaks heavily.

Royal Sovereign Shoals.

The Royal Sovereign is composed of sandstone rocks, and has only 9 feet water on its shoalest part, from which the signal-house on Beachy Head bears W. N. W. $\frac{1}{4}$ W. $6\frac{1}{2}$ miles; the first tower eastward of the Grand Redoubt at Eastbourne is in one with the western edge of Willingdon chalk-pit, N. W. $\frac{1}{4}$ N; and Fairlight mill is just seen opening of Hastings Castle cliff, N. E. by E. $\frac{1}{2}$ E.

A large nun-buoy, striped vertically white and black, with a staff and cage, is moored in 6 fathoms 100 yards southward of the 9-foot patch, with the first martello tower

eastward of Eastbourne in line with the west side of Willingdon chalk-pit, N. W. $\frac{1}{4}$ N.; the white mill north of Bexhill a little open westward of the third martello tower west of Bexhill cliff, N. E. by N.; Fairlight mill just open southward of Hastings Castle cliff, N. E. by E. $\frac{1}{2}$ E.; and the signal-house on Beachy Head W. N. W. $\frac{1}{2}$ W., $6\frac{3}{4}$ miles distant.

The Southern Head is a narrow ridge about $\frac{1}{3}$ mile long, N. N. E. and S. S. W., with 25 feet water, lying S. $\frac{1}{2}$ W. $1\frac{1}{3}$ miles from Royal Sovereign Shoal. From the shoalest part Beachy Head signal-house bears N. W. by W. $\frac{1}{4}$ W. 7 miles, and Hankham mill is in line with the eighth tower eastward of Eastbourne, or the fourth from Langley fort, N. by W. $\frac{1}{2}$ W. Close to the southern edge of this shoal there is 8 fathoms water, to the eastward 11, and 5 to 10 fathoms between it and the Royal Sovereign. There is 10 fathoms $\frac{1}{2}$ mile southward of it, and at the distance of a mile Beachy Head light opens out.

Long Shoal is a narrow bank about a mile long in a W. by S. direction, lying a little to the northward of the Royal Sovereign Shoal, with 18 to 22 feet water over it. A smaller patch called Kinsman's Nab, with 22 feet water, nearly joins its western edge, the marks for which are Willingdon chalk-pit on with the first tower, and Hankham mill just open east of the eighth tower eastward of Eastbourne.

The Horse of Willingdon lies N. W. by W. 2 miles from Royal Sovereign buoy, and from its shoalest spot, with 3 fathoms water, Hankham mill is just seen westward of the third tower from Langley fort, or the seventh tower from Eastbourne, N. $\frac{1}{2}$ W., and Beachy Head signal-house bears W. N. W. $\frac{3}{4}$ W. $4\frac{3}{4}$ miles. There are strong rippings over it.

The Elphick Tree is a small shoal patch of 30 feet water lying about $\frac{3}{4}$ mile northwest of the Horse of Willingdon; and between it and the shore, about $1\frac{1}{2}$ miles from Langley fort, is a small rocky spot with 4 fathoms water, from which the fort is in one with Hankham mill; and the three mills at Eastbourne are just open southward of the coast-guard staff, near the Redoubt.

Seaford cliff kept just in sight southward of the pitch of Beachy Head, or at night Beachy Head light kept in sight, will lead southward of the Royal Sovereign Shoals. Fairlight mill on with Hastings east cliff will lead $\frac{1}{4}$ mile eastward of Southern Head and to the eastward of all the shoals.

From Hastings a vessel may pass north of the Royal Sovereign Shoals by keeping Fairlight mill on with the east end of St. Leonards, near St. Leonard's gate.

Beachy Head should not be too closely approached, for a long narrow sandstone ledge extends from its southeast pitch S. by W. $\frac{1}{2}$ mile from the signal-house. When rounding it from the westward the light-house should be kept well open south of the Head; and in rounding it from the eastward the church at Eastbourne should be kept open east of Wish Tower cliff; but in bad weather an offing of 2 miles should be kept outside the strong rippings and heavy broken sea, which extends about $1\frac{1}{2}$ miles off shore, and is caused by a narrow ridge of rocks running out S. S. W. from the signal-house, with less than 10 fathoms water on it.

Directions:
Beachy Head to
the Downs.

If bound up channel, keep Seaford cliff just in sight southward of the pitch of Beachy Head, which will lead at least 2 miles south of Royal Sovereign Shoals, and when the two high white mills at Battle come on with the town of Bexhill, about N. N. E., or the Royal Sovereign buoy bears N., haul up about E. by N. for Dungeness. When working to windward between Beachy Head and Dungeness in thick weather, do not stand into less than 15 fathoms at low water.

The course and distance from Dungeness to the South Foreland is E. N. E. $\frac{1}{4}$ E. $20\frac{1}{2}$ miles, and the soundings vary from 17 to 13 fathoms. After rounding the Foreland at the distance of $\frac{1}{2}$ mile to 1 mile, the course is about N. E. by N. for the anchorage in the Downs. Between Dungeness and the South Foreland a depth of 12 fathoms will insure passing outside the banks off Dungeness and the rocks off Folkestone. When standing off shore the Ridge should not be approached nearer than 17 fathoms, nor the Varne than 16 fathoms. The Varne light is a good guide for avoiding these shoals. When Dungeness light bears N. W. $\frac{1}{2}$ N. a vessel will be on the line of the southwest extremity of the Ridge, and may stand toward that shoal until Varne light bears N. N. E. $\frac{3}{4}$ E. When northward of the light-vessel she may stand toward the Varne until the light bears S. W. by W.; when the South Foreland lights bear N. N. E. she will be northward of the northeast end of the shoal. When standing in-shore between Hythe and Eastware Bay, go about as soon as the South Foreland lights are shut in

by Shakspeare cliff; off Folkestone the helm should be put down when the high light disappears.

It has been stated in Chapter I that the Channel streams at each end of Dover Strait set toward Dover while the water is rising there, and in the opposite direction while it is falling. A vessel, therefore, if she carries the eastern or flood stream as far as Hastings, will have a continuation of easterly tide for 4 hours longer, and if sailing 8 knots, will carry it nearly to the North Foreland. If she can get to the eastward of Hastings by high water, when working to windward, she may advance as far as the West Road of Dungeness before the tide makes to leeward; but if not to windward of Hastings by an hour after high water, she will get no farther, and may keep under weigh or anchor for the tide, as convenient.

The loss of ships on the coast of France, in the vicinity of Boulogne, has been attributed to the rotary action of the stream; but there is more reason to believe that they have been set to the eastward of their reckoning, and deeming themselves westward of Dungeness have been steering E. while they were 10 miles beyond it, when probably the stream has commenced running to the S. W., and, catching them on the port bow, has set them over on the French shore. The mariner will do well, therefore, to study the set and turning of the stream, and on no account to neglect the lead.

It may be useful to remark that the electric light on Cape Gris-Nez bears E. by S. 51 miles from Beachy Head, S. E. by E. $\frac{1}{2}$ E. 23 $\frac{1}{4}$ miles from Dungeness, and S. $\frac{1}{4}$ E. 18 miles from the South Foreland. It is a revolving bright light, attaining its greatest brilliancy every half minute, and should be seen in clear weather from a distance of 25 miles. The eclipses are not total in clear weather within the distance of 12 miles. This light cannot be mistaken for the fixed light at Calais, which is varied every 4 minutes by a bright flash; nor for the fixed light at Cape Alprech, which is varied every 2 minutes by a red flash.

Hollywell Bank. A bank of large rocks, which dry 1 foot at low water, lies $\frac{1}{4}$ mile off Wish tower, which stands on the sandstone cliff to the southeast of Eastbourne. The long mark for the bank is the square tower of Westham church in line with the eastern edge of the Grand Redoubt; but a vessel to

tack clear of it must have the church half way between the redoubt and the first tower to the eastward. A ridge of sand runs from this bank in a S. W. $\frac{1}{2}$ W. direction nearly parallel with the coast, and terminates to the southeast in Hollywell Bank, $\frac{1}{2}$ mile eastward of Beachy Head Ledge. The Bank carries a depth of 8 to 12 feet, with 14 to 17 feet in a narrow gut named Whitbread Hole, between it and the shore.

Westham church open east of the Grand Redoubt leads eastward of Hollywell Bank; and the little spire of Hertsmonceaux church in one with the western part of Westham church, or Hankham mill on with the battery-houses on Langley Point, lead between it and the Royal Sovereign Shoals.

Hollywell Ledge is a ridge of high sandstone rocks commencing abreast the chalk cliffs to the southwest of Wish tower, and terminating a little below the lime quarries. A large sandy flat extends along shore between it and the cliffs, on which vessels ground to load with lime, protected by the ledge from the break of the sea. Hollywell Ledge.

Eastbourne Bay affords good shelter with the wind between W. and N. E. by E., in $3\frac{1}{2}$ fathoms, sand, abreast the Grand Redoubt, with Willingdon church spire open west of the redoubt, and the towers to the northward of Langley Point just opening east. Eastbourne Bay.

It is high water at Eastbourne, full and change, at 11h. Tides.
3m.; springs rise $21\frac{1}{2}$ feet, neaps 17 feet.

A life-boat is stationed at Eastbourne, which is a coast-guard station. Life-boat.

Pevensey Bay, between Langley Point and Walls-end houses, affords good anchorage to small vessels, over sand and mud, with the wind northward of W. S. W. They should bring up abreast the third tower northward of Langley Point, with Beachy Head signal-house just open of Langley Point, or Pevensey church or castle bearing N. $\frac{1}{2}$ E. Pevensey Bay.

Pevensey Shoal is an isolated patch lying N. N. E. $\frac{1}{2}$ E from Royal Sovereign Shoal, about midway between it and the shore, with $2\frac{3}{4}$ fathoms over, and 5 to 6 fathoms close to and around it. Beachy Head bears W. $\frac{1}{2}$ S. from it, and the coast-guard house at the east end of Pevensey Bay N. by W. Between Pevensey and Royal Sovereign Shoals are some patches with $4\frac{1}{2}$ and $4\frac{3}{4}$ fathoms water. Pevensey Shoal.

Pevensey Bay
to Hastings.

The land on this part of the coast rises but little above the level of the sea until toward Hastings, where it again becomes elevated, and appears double, rising high in the interior. Between Beachy Head and Fairlight the strand, on which are many martello towers, is composed of coarse shingle studded here and there with small rocky heads, particularly in the vicinity of Hastings and Cliffs-end Point. Fairlight Down, the highest land hereabout, is often the first land-fall, and may be known by a mill, and a church with a square tower, which stand on it at the respective elevations of 626 feet and 597 feet above high water. The summit of the Down is green pasture land, and the face of the cliff gray sandstone.

Bexhill stands on the first rising ground westward of St. Leonards, and is conspicuous from seaward, having a church with a low tower on the summit among the trees, and a remarkable high white house to the westward of it.

Off Galley hill, which is the nearest cliff eastward of Bexhill, and the second westward of St. Leonards, are several rocks 2 or 3 feet above water; and a little westward of these, $\frac{1}{2}$ mile off shore, bearing between S. by E. and S. S. W. from Bexhill church, are several rocks awash, called Bexhill Reef, with 6 feet water between them and the shore. Fairlight mill over the west end of St. Leonards leads south of them in 7 feet at low water.

To the westward of Galley hill, off towers Nos. 4, 5, and 6, and $\frac{1}{2}$ mile from the shore, a reef named the Oyster dries in several spots at low tides; this as well as Bexhill Reef will be avoided by not going north of the line of Willingdon chalk-pit on with the first tower eastward of Walls-end houses. No good anchorage will be found between Galley hill and the sluice-houses to the westward, as the ground is foul, and several rocky patches with 8 to 12 feet water, called the Coxheath Shoals, lie $\frac{1}{2}$ mile outside Oyster Reef, and nearly a mile to the southward of the fifth tower (No. 50) west of Galley hill. Willingdon chalk-pit on with the second tower to the westward of Walls-end houses, or Fairlight mill over the west end of St. Leonards, leads south of all the foul ground between Bexhill and the sluice-houses.

Hastings.

Hastings is between Bexhill and Fairlight, just westward of the sandstone cliffs, the greater part of the town being in the valley between East hill, or Rock-a-nor Point, and

West hill, on which stand the ruins of an old castle and three conspicuous wind-mills. St. Leonards is the continuation of Hastings in a westerly direction, and consists of well-built terraces. The anchorage off the town is only used by vessels having to discharge a cargo on the beach, or to wait a tide, for with the wind to the southward of W., a heavy sea rolls in on the coast. They usually bring up with Fairlight high coast-guard house well open of the cliff. Several rocky ledges extend some distance from the shore, and are dangerous to vessels when covered, but the brow of the high land some distance to the northward of Beachy Head (Firle beacon hill) kept on with, or a little south of Galley hill martello tower will lead southward of them. The shore being flat and rocky is a bad beaching-place for boats; the best, however, is abreast the fish-market, near the eastern part of the town.

To assist the fishermen in running on shore a fixed red light is displayed 30 feet above high water from an octagonal white building on the beach near the fish market, and N. N. E. 300 yards from it, on the side of West hill above the town, a fixed bright light is shown at an elevation of 60 feet. Lights.

There is a life-boat at Hastings. Life-boat.

It is high water at Hastings, full and change, at 10h. 53m.; springs rise 24 feet, neaps 17½ feet. Tides.

Tower Knoll lies a mile off shore between Fairlight and Rye, and from its shoalest part, in 6 feet water, the third tower to the eastward of Hook Point (No. 36) is in line with Dog's Hill mill, which is black, and stands westward of the thick wood at Winchelsea. Tower Knoll.

Outside of Tower Knoll is Boulder Bank, a ridge of sand with several banks of coarse gravel and stones on it, lying about 2 miles off the coast abreast the eastern side of Fairlight hills. Bexhill just open of St. Leonards, or St. Leonards well open of the east cliff at Hastings, leads southward; and Playden church-steeple in one with the turret of Rye church, well to the eastward of it. Boulder Bank.

A long tail, called the Four-Fathom Sand Ridge, extends several miles to the W. S. W. from Boulder Bank, over which a vessel of 18 feet draught coming from the eastward may stand, when Fairlight church bears N., and tack in-shore abreast Fairlight cliffs in any convenient depth.

Life-boat.

A life-boat is stationed at Winchelsea.

Rye.

Rye Harbor, at the mouth of the river Rother, is chiefly used by coasters and fishing-vessels, and, being difficult of access, the services of a pilot are indispensable. There is a steam-tug, the signal for which is a wift at the peak, or burgee at the main, and a patent slip, on which vessels of 90 feet keel and 300 tons burden have been hove up for repairs at ordinary springs.

Lights.

Two fixed bright lights, 180 yards apart, are exhibited near Camber at the north side of the entrance of Rye Harbor, while there is 10 feet water or more on the bar. They are elevated respectively 47 and 24 feet above high water, and are visible about 5 miles.

A red light is shown 32 feet above high water on the east side of the entrance, S. E. 216 feet from the old pier-head, during neap tides, when there is 8 feet water at the gauge-board; and continues burning until there is 10 feet, when it is extinguished and the two usual bright lights exhibited. When there is not 10 feet flow of tide, this light is shown till high water. When the depth is 12 feet at the gauge-board the red light is again exhibited, in addition to the two bright lights, remaining until high water, when it is extinguished.

There is also a red light 19 feet above high water on the Dolphin, to show the end of the eastern pier. This light is shown when it is flood at the pier, and burns until about 2 hours after high water.

There is also a green light at the extremity of the new groyne on the western side of the entrance, which is shown from half flood to about half ebb.

The two bright lights in one, N. $\frac{1}{2}$ W., lead over the sand in front of the entrance in the depth indicated by the signals, and between the green light on the groyne and the red light on the east pier-head, which are 87 yards apart N. E. and S. W.

Life-boat.

A life-boat is stationed at Rye.

Tides.

It is high water, full and change, in Rye Bay at 11h. 20m.; springs rise 22 feet, neaps 17 $\frac{1}{4}$ feet. Springs rise 16 feet at the point, 12 $\frac{1}{2}$ feet at the town, and 11 $\frac{1}{2}$ feet at the float-sluice. The depth in the harbor is 15 to 16 feet at high-water springs, and 10 to 11 feet at neaps. The flood runs in round the beach with a velocity of 6 knots, but its rate lessens in-

side. During the strength of the tide it would not be prudent to leave the harbor, but it slackens about half an hour before high water.

The telegraph at the entrance of the harbor, near the flag-staff, shows the flowing of the tide. The frame and shutters are black, and when not in use appear all black; when in use the shutters are canted horizontally, so as to show a circle of light through the frame. When there is 8 feet water one shutter is canted; when 9 feet both shutters are canted; when 10 feet the flag is hoisted; when 11 feet one shutter is canted; and when 12 feet both shutters are canted. So that the shutters without the flag denote under 10 feet, and with the flag above 10 feet. When there is more than 12 feet, red flags are hoisted on the telegraph flag-staff. One flag hoisted half-mast denotes 13 feet, and hoisted up 14 feet. Two flags at half-mast denote 15 feet, and hoisted up 16 feet.

Tidal signals.

A black ball is hoisted on the ball-pole, at the harbor flag-staff, in bad weather, or during low tides, to signify that the pilots cannot get off, and that the harbor cannot be approached with safety by strangers. A blue burgee on the ball-pole signifies high water at the pier-head.

When approaching the entrance of Rye Harbor, look out for the black buoys on the western edge of the channel, and, having left them on the port hand, and the red and white buoy on the starboard hand, steer to pass to the southwest of the red and white buoy placed at the end of a low stone-work extending 600 feet from the Dolphin, and over which there is the depth indicated by the tidal signals. Thence the two tide-lights in one lead up to the pilots' houses on the point, leaving all the broom beacons on the low stone-work to starboard, and the triangular beacon and the beach to port. When as far up as the pilots' houses, either anchor or make fast alongside one of the berthing places on the eastern shore.

Directions.

About $3\frac{1}{4}$ miles W. $\frac{1}{2}$ S. from Dungeness is the eastern end of a narrow ridge of sand, called Stephenson Shoal, which extends thence nearly $\frac{3}{4}$ mile in the same direction, and carries a depth of 19 to 23 feet, with 4 to 5 fathoms water around it. The east mill at Lydd in line with No. 4 coast-guard houses, N. N. E. $\frac{1}{2}$ E., leads eastward of the eastern end in 5 fathoms; Rye church on with the new church-spire

Stephenson
Shoal.

near Rye Harbor, N. N. W. $\frac{3}{4}$ W., clears the western end in 27 feet; Fairlight church and mill in one, W. N. W., leads $\frac{1}{2}$ mile southwest of it, and the South Foreland and Dungeness lights in one, E. N. E. $\frac{1}{4}$ E., lead $\frac{3}{4}$ mile southward of it.

Dungeness.

Dungeness is the southeast extremity of the extensive level tract called Romney Marsh. The shingle beach is here low and flat, the highest part being only 4 feet above the level of high-water springs; off the pitch of the Ness near the light-house it is steep-to, there being 4 fathoms 100 yards from the beach, and 15 fathoms at the distance of 330 yards.

Light-house.

A circular tower 107 feet high, with red and white horizontal bands, stands on the point 422 yards from high-water mark, and exhibits, at an elevation of 92 feet above high water, an electric light which should be visible in clear weather from a distance of 15 miles.

From a window below the lantern a red light is shown, which is visible from the westward when bearing southward of E., and from the eastward when bearing between S. W. $\frac{1}{2}$ S. and S. W. by W. $\frac{1}{2}$ W.

Daboll's fog-horn is sounded during fogs, its mouth traversing between N. E. by E. $\frac{1}{2}$ E. and W. $\frac{1}{2}$ N. once in each minute. It is sounded in blasts of 5 seconds' duration, with intervals of 20 seconds between them.

Beacon.

In consequence of the rapid accumulation of the beach at Dungeness, a beacon will be erected to define its extremity. The beacon will consist of a mast 50 feet high with two large globes placed vertically thereon; it will be located a few yards above high-water mark, about 400 yards S. E. $\frac{1}{2}$ E. from the light-house.

Life-boat.

A life-boat is stationed at Dungeness.

Anchorage.

The roads on either side of Dungeness afford excellent and extensive anchorage, according to the state of the wind, with good holding-ground of fine sand over clay and mud.

The West Road comprises the space between the first building westward of the light-house and the black coast-guard buildings at Jewrys Gap. It affords good shelter from winds between N. and E. by S., and is much frequented by vessels bound up the Channel. The best anchorage is in about 6 fathoms, with Romney church tower in one with Lydd church, N. E. $\frac{3}{4}$ E., and Dungeness light-house E. $\frac{1}{4}$ S.

Small vessels may run farther in toward the beach, guarding always against a sudden shift of wind. The western tide runs easy, and affords a good slack for running or working in.

The East Road affords good shelter from westerly winds between S. W. and N. by E., in 4 to 12 fathoms. A good position is in 7 fathoms, with Lydd church just open north of No. 2 battery, N. W. by W. $\frac{3}{4}$ W., and the light-house S. W. by W. $\frac{1}{4}$ W.

At night the outer limits of both anchorages are indicated by the red light in Dungeness light-house.

The magnetic variation was $19^{\circ} 18'$ W. at Dungeness in 1870; decreasing at the rate of $7'$ annually. Magnetic variation.

It is high water at Dungeness, full and change, at 10h. 45m.; springs rise $21\frac{3}{4}$ feet, neaps 19 feet. The duration of the flood is considerably less than that of the falling tide, the former flowing $5\frac{1}{2}$ hours, and the latter ebbing 7 hours. During the strength of the eastern stream there will be found a slack in-shore between Dungeness and Hythe; and during the western stream there is a slack between Dungeness and Fairlight. Tides.

In the East Road of Dungeness are the Newcome, Swallow, and Roar Banks. Newcome Bank is an accumulation of sand contiguous to the beach, about $1\frac{1}{2}$ miles northward of Dungeness, and must be carefully avoided when standing in-shore, or running for the road. A checkered black and white buoy, marked Roar Spit, is moored in 16 feet water on the edge of the bank, and from it Dungeness light-house bears S. W. $\frac{1}{4}$ W. $1\frac{1}{2}$ miles; and the first battery on the beach northward of the light-house W. by N. $\frac{3}{4}$ mile. Shoals in E. Road; Newcome Bank.

Swallow Bank, lying directly in the anchorage, has a shoal spot of 18 feet, from which Dungeness bears S. W. $\frac{1}{4}$ W. $2\frac{3}{4}$ miles, and Romney church N. W. by W. Lydd church open north of the second battery northward of the light-house, N. W. by W. $\frac{3}{4}$ W., leads southward of it in 31 feet water; and the light-house W. S. W., or Beachborough summer-house in line with Hythe church, N. E. by N., leads eastward of it. Swallow Bank.

Roar Bank is a narrow ridge of sand running nearly parallel with the coast $1\frac{1}{2}$ miles from high-water mark. Its southwest end is abreast the large opening called Romney Bay, and thence it extends N. E. by N. $2\frac{1}{2}$ miles, terminat- Roar Bank.

ing n 14 feet water about S. S. E. $1\frac{1}{4}$ miles from Dymchurch. It carries a depth of 9 to 12 feet, with 2 and 3 fathoms water between it and the shore, and should not be approached within the depth of 6 fathoms.

Shoals in Dover Strait.

The Strait of Dover is obstructed by several extensive banks of coarse sand and broken shells, the most dangerous of which are the Vergoyer, the Basurelle, the Ridge or Le Colbart, and the Varne. The Ridge and Varne lie nearly parallel to each other in the middle of the Strait, and like the others consist of shoal patches with deep water between them.

Vergoyer Shoal.

The Vergoyer is a sand-bank, about 14 miles in length, N. E. by E. $\frac{1}{2}$ E. and S. W. by W. $\frac{1}{2}$ W., and a mile in breadth, lying 10 to 15 miles from the coast of France. The general depth on its southern part is 5 to 7 fathoms, the southeastern edge being steep-to, and the northwestern edge of a gradual slope; but near its northeastern extremity is a spot about a mile in diameter, with only 12 feet at high-water springs. From this spot, which is about 10 miles off shore, the land is visible in clear weather from the hills (at the foot of which stands the town of Etaples) to Cape Gris-Nez light-house, which bears about N. E. $\frac{3}{4}$ E. $19\frac{1}{2}$ miles distant. The light-house on Cape Alprech bears E. $\frac{3}{4}$ N. $11\frac{1}{2}$ miles, and can be seen only when it is very clear; in fine weather the light is visible. The ripples on this shoal during springs occasion a high sea on a weather tide; and with a strong breeze from any quarter the sea breaks with violence on the northern end, especially from half-flood to half-ebb.

Lydd church in sight to the west of Dungeness light-house, N. N. W., leads to the northeastward of the Vergoyer; and Mount Lambert midway between Outreau church and Alprech guard-house, E. $\frac{1}{4}$ S., leads northward of it.

Bassurelle Shoal.

Bassurelle Shoal lies about S. $\frac{1}{2}$ W. 18 miles from Dungeness and W. $\frac{3}{4}$ N., an equal distance from Cape Alprech, and within the depth of 10 fathoms is about 5 miles long E. N. E. and W. S. W., and 2 miles wide. Its shoalest parts form a succession of elevated flats, the most considerable of which lie toward the northeast extremity of the bank, and serve as a basis for eight small hillocks of sand, upon the highest of which a depth of 22 feet at

low-water springs was found in 1835. This bank is steep-to and dangerous to vessels of great draught at low water; at springs there is a strong rippling over it, and in bad weather, during the weather tide, the sea breaks violently upon its highest parts.

Mount Lambert semaphore just open south of the guard-house on Cape Alprech, E. $\frac{1}{4}$ S., leads southward of it; and Romney church open west of Dungeness light-house, N. by E., leads westward of it.

Bullock Bank is S. $\frac{1}{4}$ W. 11 miles from Dungeness, and its position is indicated by strong rippings. There is 9 to 10 fathoms water over it, 17 fathoms half a mile from it northward and southward, and a general depth of 11 to 14 fathoms between it and the southwest end of the Ridge and Les Ridens. Romney church a little open east of Dungeness light-house, N. $\frac{1}{2}$ E., leads over this bank in 9 fathoms.

Bullock Bank.

Les Ridens is a bank composed of several patches of sandstone and gravel lying S. S. E. $\frac{1}{2}$ E., nearly 16 miles from Dungeness, about $3\frac{1}{2}$ miles S. by W. from the southwest end of the Ridge, and W. N. W. 12 miles from the Napoleon column at Boulogne. There is 6 to 10 fathoms water over it, and its position is indicated by strong rippings when the tide runs with any strength, and by a heavy sea in bad weather. Cape Blanc-Nez well open of Cape Gris-Nez leads north of this bank, and when shut in leads south of it.

Les Ridens.

The Ridge, called by the French Le Colbart, is about $8\frac{1}{2}$ miles long, S. W. $\frac{1}{4}$ W. and N. E. $\frac{1}{4}$ E., and $\frac{3}{4}$ mile wide. It is steep-to, and is composed of sand and broken shells, the shoal patches lying in ridges across the stream, which occasion strong eddies even at neap tides. There is much sea on it during a weather tide, and in bad weather there are breakers on the shoalest parts; no vessel should attempt to cross it under any circumstances. The shoalest water on the Ridge, 6 feet, is about $2\frac{3}{4}$ miles from its southwest end, with Varne light-vessel bearing N. $\frac{3}{4}$ E. nearly 5 miles; Cape Gris-Nez E. S. E. $\frac{1}{4}$ E. $10\frac{1}{2}$ miles, with the summit of Mount Couple appearing a little south of it; and Dungeness light-house N. W. $\frac{3}{4}$ W. $13\frac{1}{4}$ miles. From the northeast extremity of the Ridge, in 7 fathoms, Cape Gris-Nez bears S. E. $\frac{1}{2}$ S. $8\frac{3}{4}$ miles; the high trees at the back of Hythe are in line

The Ridge or
Le Colbart.

with the Swisster race at Sandgate, N. N. W. $\frac{1}{2}$ W.; and Varne light-vessel bears W. N. W. $\frac{1}{4}$ W. 4 miles.

Mount Lambert, a conspicuous hill near Boulogne, with a fort on it, in one with the dome of the new cathedral at Boulogne, S. E. $\frac{1}{4}$ E.; or Sandgate Swiss terrace between the two chalk-pits, N. $\frac{3}{8}$ E., or the revolving light on Cape Gris-Nez bearing E. $\frac{1}{4}$ S., lead south of the southwestern extremity of the Ridge in 9 fathoms.

Varne Shoal.

The Varne Shoal is about $4\frac{1}{2}$ miles long N. E. by E. and S. W. by W., between the depths of 7 fathoms at each end, and $\frac{1}{2}$ mile to $\frac{3}{4}$ mile wide. Its southwestern extremity is about 2 miles from the northeastern part of the Ridge, and there is 16 to 20 fathoms water between them. This bank is steep-to, and from its shoalest spot, which is about a mile from the northeast end, and has 9 feet water, Dover Castle bears N. by E. $\frac{1}{4}$ E. $8\frac{1}{2}$ miles. From the northeast end of the shoal the South Foreland bears N. N. E. $8\frac{1}{4}$ miles, and Dover Castle N. $\frac{3}{4}$ E. 8 miles; from the southwest end Dover Castle bears N. N. E. $\frac{1}{2}$ E. $11\frac{1}{4}$ miles, and Dungeness light-house W. N. W. $\frac{1}{2}$ W. $12\frac{3}{4}$ miles. There are strong rippings over the Varne, both at springs and neaps, and during tempestuous weather a heavy sea, which would endanger any vessel attempting to cross it. Folkestone church, seen between two conspicuous chalk-pits on the face of the distant hills, N. W. by N., clears the northeast end of the shoal in 7 fathoms, leading a mile northeastward of the 9-feet patch, and about 2 cable-lengths southwest of the N. E. Varne buoy; and the eastern terrace at Sandgate between the same chalk-pits, N. $\frac{3}{4}$ W., or the square tower of Lympne church on with Lympne wind-mill, clears the southwest end.

Light-vessel.

The Varne light-vessel lies in 15 fathoms about a mile W. N. W. $\frac{1}{2}$ W. from the depth of 7 fathoms on the southwest end of Varne Shoal, and exhibits at an elevation of 38 feet above the sea a revolving red light, which attains its greatest brilliancy every 20 seconds, and should be visible in clear weather from a distance of 10 miles.

She has one mast with a ball at mast-head, and from her Dungeness light-house bears W. N. W. $\frac{3}{4}$ W. $11\frac{3}{4}$ miles; Folkestone church N. $\frac{1}{4}$ W. $9\frac{1}{4}$ miles; South Foreland high light-house N. E. $\frac{3}{4}$ N. $12\frac{1}{2}$ miles; N. E. Varne buoy N. E.

by E. $\frac{1}{4}$ E. $5\frac{1}{2}$ miles; and Cape Gris-Nez light-house S. E. $\frac{3}{4}$ E. $12\frac{1}{2}$ miles.

The S. W. Varne buoy is a black can-buoy in 9 fathoms Buoy. on the southwest end of the shoal, S. E. by E. 0.8 mile from the light-vessel.

The N. E. Varne buoy is a large red spiral buoy, surmounted by a staff and ball and marked N. E. Varne; it is moored in 13 fathoms off the northeast end of the shoal, with Dungeness light-house bearing W. northerly 16 miles; Folkestone church N. W. $\frac{3}{4}$ N. 8 miles; South Foreland high light-house N. N. E. 8 miles; Cape Gris-Nez light-house S. S. E. $\frac{1}{4}$ E. $11\frac{1}{2}$ miles; and Varne light-vessel S. W. by W. $\frac{1}{2}$ W. $5\frac{1}{2}$ miles.

Upon the Varne and Ridge it is high water, full and Tides. change, at 10h. 40m.; the northeastern stream commences at $4\frac{1}{2}$ hours flood, and the southwestern stream at $4\frac{3}{4}$ hours ebb, making $6\frac{1}{2}$ hours of northeastern and $5\frac{1}{2}$ hours of southwestern tide. Strong gales from the westward prolong the northeastern stream nearly an hour, and retard proportionally that to the southwestward, so that on some occasions, especially on the Ridge, 8 hours of northeastern and only 4 hours of southwestern tide have been found.

Between the Vergoyer and the French shore both ebb and flood make an hour sooner on an average than in the offing.

Three pilot-cutters cruise between Dungeness and the South Foreland, to supply vessels from the westward with Pilots. pilots; one will be found off Dungeness, the second in the fairway between Dungeness and Dymchurch, and the third off Folkestone, well out in the fairway.

The shallow extending from the shore between Dymchurch and Shorncliff battery is called Hythe Flat. The Dungeness to Sandgate. least water on it is 22 feet, and its outer edge, in 5 fathoms abreast the martello tower, is about 2 miles off shore. A large vessel standing toward it should go about as soon as the South Foreland high light-house or light is shut in by Shakspeare cliff.

About $2\frac{1}{2}$ miles to the southwest of Hythe is a circular redoubt called Brockman's barn, at which commences the well-known Dymchurch wall, a sea embankment for the rich pasturage of Romney Marsh.

Sandgate Road. Sandgate Road, off Sandgate, is much frequented by light vessels bound to the northward, as the western stream is easy, and affords good shelter with the wind to the northward of E. by N. They anchor abreast the castle with the pier-clock at Folkestone just clear of Mill Point in 6 to 8 fathoms water over good holding-ground of mud and clay.

Folkestone Harbor. About $1\frac{1}{2}$ miles eastward of Sandgate, between Mill and Copt Points, is the tidal harbor of Folkestone, belonging to the Southeastern Railway Co., and used by their steamers which ply to Boulogne. It incloses an area of about 14 acres, and has room for a few small vessels, but is not used for refuge. The entrance is awash at low-water springs. There is a patent slip in the harbor 450 feet long, and 19 feet gauge, but it is only used for the company's steamers; also a gridiron 220 feet long capable of receiving a vessel drawing 9 feet. A pier projects 120 yards in a southeast direction just westward of the entrance with a depth of 12 feet at its end at low-water springs. Mooring-anchors are laid down at convenient distances with chains led toward the pier, with which they are connected by smaller chains, so as to enable vessels to heave in the larger chain if necessary.

The coast near Folkestone is bordered by rocky ledges extending $1\frac{1}{2}$ to 3 cable-lengths off shore. Those off Mill Point and abreast Folkestone church cover at 4 feet flood, when they become dangerous to coasters, as it is not easy to estimate the distance from the shore; Hythe church open of the stone wall fronting Shorncliff battery leads S. W. of them.

Copt Ledge extends off Copt Point, and is composed of large sandstone rocks, which uncover 6 feet at low-water springs. The Mole-head Rocks are a continuation to the westward of Copt Ledge, and uncover 2 feet. The two western martello towers near Hythe just open of the low part of Mill Point lead south of Copt Ledge and Mole-head Rocks.

Lights.

On the south pier-head at the entrance of the harbor is a white light-house 31 feet high, which exhibits, while there is 10 feet water between the pier-heads, a fixed red light 37 feet above high water, visible 6 miles in clear weather. A bright light is shown under the red light when the depth exceeds 16 feet. When the red light is blinked at intervals,

it indicates that caution is necessary, and when the lights are not exhibited there is less than 10 feet water, or the harbor is inaccessible on account of the weather, or some obstruction in the fairway.

At the extremity of the new pier, S. $\frac{1}{2}$ W. 212 yards from the above, is an iron skeleton light-house 28 feet high, which exhibits at an elevation of 31 feet above high water a light which shows green from seaward when bearing between W. $\frac{1}{2}$ N. and E. N. E. $\frac{1}{4}$ E., and bright in-shore of these bearings. These limits lead about 65 yards outside the Oak End Rocks on the west side of the pier, and the same distance outside the Mole-head Rocks on the east side. The light should be visible in clear weather from a distance of 6 miles.

A red flag is shown at half-mast on a flag-staff at the south pier-head while there is 10 to 14 feet water between the pier-heads; and is hoisted up when there is 14 to 16 feet. When the depth exceeds 16 feet a black ball is shown under the red flag. When the flag is hauled down to the foot of the staff it indicates that caution is necessary; and when it is not shown there is less than 10 feet water between the pier-heads, or some obstruction in the fairway, or the harbor is inaccessible on account of the weather.

Tidal Signals.

It is high water at Folkestone, full and change, at 11h. 7m.; springs rise 20 feet, neaps 16 $\frac{1}{2}$ feet.

Tides.

The average depth is 20 $\frac{1}{2}$ feet between the pier-heads at high-water ordinary springs, and 14 feet at neaps. During the equinoctial months, and preceding heavy gales, there is sometimes 23 feet between the pier-heads at springs and 16 feet at neaps; and during settled fine weather not more than 10 feet at neaps. In the outer harbor there is 17 feet at high-water springs and 13 feet at neaps. The difference of level between the entrance of the outer harbor and the west end of the inner harbor is 5 feet, and vessels of 13 or 14 feet draught may safely enter the latter at high-water springs.

All vessels are strictly cautioned against entering this harbor when the red flag is not shown by day, or the red light at night. When entering it must be remembered that with the flood there is generally a strong set toward the south pier-head, and an eddy along the shore from Copt Point toward the entrance. The Royal George hotel, which has three large stacks of chimneys, in line with the light-

Directions.

house on the south pier-head, will lead westward of the Mole-head Rocks; but if there is any swell on, it will be safer to keep the hotel open south of the light-house until the vessel is about two ship's lengths from the pier-head.

The anchorage off Folkestone is only used by vessels waiting tide to go into harbor, for it is much exposed, and there is not room for more than four or five vessels to ride at the same time. The best holding-ground is in 7 to 10 fathoms, clay and sand, with the pier light-house in line with the eastern houses near the north side of the harbor, bearing N., and the church in one with a terrace on the beach west of the clock-house. At night keep the red light a little open west of the green light on the new pier.

Folkestone to
Dover.

Eastward of Folkestone, between Copt Point and the railway tunnel through Abbots Cliff, is Eastware Bay, which has good holding-ground, and is well sheltered on the west side by Copt Point and Ledge, but it can only be recommended as a temporary anchorage for vessels waiting tide. The best berth is in about 5 fathoms, abreast the coast-guard cottages under the cliffs, with Folkestone church a little open of Copt Point. The shore of the bay is flat and covered with large stones, which makes bad landing at low water. Between this bay and Shakspeare Cliff there is no good anchorage off the coast, as the water is deep and the ground foul.

Shakspeare cliff is the first chalk-cliff westward of Dover, and when seen from the eastward presents a conical appearance; but from the southward there is nothing remarkable in its features; on its summit is a flag-staff on which storm-signals are hoisted.

Dover.

About 5 miles east of Folkestone is Dover Bay, in the western part of which is the town of Dover, easily recognized by the castle on an eminence to the eastward. The Admiralty pier runs out in a S. S. E. direction from Cheeseman Head, 167 yards westward of the entrance to the harbor, and is at present 533 yards in extent. Vessels of great draught can go along either side of it at any time of tide; and fresh water can be obtained in abundance. A buoy is placed off its extreme end where there is 6 to 7 fathoms water, but vessels should give it a wide berth to avoid the strong eddy. At half-flood the eddy makes to the westward out of Dover Bay, and meeting the offing

stream running to the eastward at the end of the pier, causes a heavy sea in westerly gales; but thence to the entrance of the harbor the water in the space sheltered by the pier is smooth.

The port has an outer or tidal harbor with an area of 12 acres, and within it an inner harbor of 6 acres, and a pent of $11\frac{1}{2}$ acres. The entrance is between two piers 140 feet apart, open to the southeast, and careful steering is necessary when entering with on-shore gales. The best time to enter is about $1\frac{1}{2}$ hours before, or 2 hours after, high water. There is 19 feet water at the entrance at high-water springs, and 12 to 15 feet at neaps. The outer harbor has 17 feet in it at high water springs, and 10 to 13 feet at neaps, and dries an hour before low water; but the depths are quite uncertain, as much depends upon the wind, which at times makes a great difference in the flow.

In the inner harbor, and in the pent, there is a foot less water. The gateway between the outer harbor and the pent is 56 feet wide; that between the inner harbor and the pent 47 feet, and the swinging-bridge gateway between the outer and inner harbors has a width of 37 feet. There is a patent slip worked by steam in the pent; it is 450 feet in length, with a cradle 115 feet long, and is capable of taking a vessel of 500 tons.

Two red tidal lights are exhibited at unequal heights from a staff on the south pier-head, and there are also low red lights on the north and south pier-heads. The latter are lighted when there is 7 to 10 feet water at the entrance; the two lights on the staff, and that on the north pier-head, are shown when there is more than 10 feet. They only point out the position of the piers, and do not indicate that of the channel, which continually varies with the shifting of the sands.

Lights.

There is a fixed green light near the clock-tower, which seen between the piers leads into the fairway to and up the harbor.

A fixed blue light is shown from the extremity of the Admiralty pier, and in foggy weather a bell is sounded.

A life-boat is stationed at Dover.

Life-boat.

It is high water at Dover, full and change, at 11h. 12m.; equinoctial tides rise $20\frac{1}{2}$ feet, ordinary springs $18\frac{3}{4}$ feet, and neaps 15 feet.

Tides.

Signals.

By day a red flag is hoisted with a black ball under it while there is 7 to 10 feet water at the entrance, the red flag alone while there is 10 to 13 feet, and the ball over the flag when there is more than 13 feet. No signals are made when there is less than 7 feet, and when, at other times, the harbor is inaccessible to vessels the flag is hauled down, or the lights on the south pier are extinguished.

On the north end of the north pier there is a private flag-staff for the purpose of acknowledging vessels' numbers as they pass the port, either outward or inward bound, and they are immediately reported by telegraph to Lloyds.

Anchorage.

During the prevalence of northeasterly winds Dover Bay is much frequented by coasters bound to the northward, the usual anchorage being abreast the Esplanade with the South Foreland light-houses shut in by the hills, but small steamers anchor closer in-shore. With easterly winds the mail-packets either anchor off or haul alongside the western side of the pier. The Admiralty pier affords shelter from winds westward of W. S. W., and though with these winds a heavy swell is experienced it is not dangerous, as the strong eddy created by the breakwater sets to the westward, and thus becomes a weather-tide. The anchorage, however, on either side of the pier should only be considered temporary, especially for large vessels or those without steam-power, for there is but little shelter, and the holding-ground is not good; it should be quitted, therefore, as soon as the pier becomes a lee shore.

Vessels using the anchorage in Dover Bay during westerly winds should avoid anchoring with the end of the Admiralty pier on a S. W. by W. bearing; for on this line, between five hours' flood and half ebb, the eastern stream, carrying the westerly swell with it up Channel and running close past the end of the pier with great velocity is there met by the eddy or out-flow from Dover Bay, which, opposing the progress of the advancing swell, throws up a short turbulent sea along the line of contact in a N. E. by E. direction from the pier-end, causing vessels to roll and surge about, risking fouling their anchors and snapping their chains. Large vessels should therefore anchor outside this line in not less than $5\frac{1}{2}$ to 6 fathoms at low water, with the keep of Dover Castle within or westward of the castle-jetty, one-third the distance toward the boundary groyne, bearing

N. $\frac{1}{2}$ W., and the end of the Admiralty pier W. or W. by S.; Shakspeare Cliff will then be nearly in line with the inner landing stage of the Admiralty pier. Small vessels should anchor with the entrance of Dover Harbor open, and not farther out than to have the end of the Admiralty pier bearing S. W. by S.

The South Foreland is a bold head-land, faced with irregular chalk-cliffs, having layers of flint in horizontal lines. It bears E. N. E. $\frac{1}{4}$ E., $20\frac{1}{2}$ miles from Dungeness, and N. $\frac{1}{4}$ W. $17\frac{3}{4}$ miles from Cape Gris-Nez. The chalk-cliffs extend along the coast to the northeastward nearly as far as Walmer Castle.

Near the edge of the cliff is an octagonal white light-house, 49 feet high, which exhibits, at an elevation of 275 feet above high water, a fixed bright light, which should be visible in clear weather from a distance of 23 miles.

A square white light-house, 69 feet high, stands 449 yards W. by N. from the above, exhibiting a fixed bright light 372 feet above high water, and visible 26 miles.

These two lights in one, W. by N., lead a mile south of the Goodwin Sands.

The submarine cable to Belgium extends E. by S. from the South Foreland, with the light-houses in line, W. by N., passing about a mile south of the South Sand Head light-vessel, and afterward running E. S. E. to the Flemish banks. Vessels are cautioned not to anchor with this mark or bearing on, lest they damage the cable or lose their anchors.

There is also a cable to France, and to prevent injury to it vessels should not anchor within 3 or 4 miles from the South Foreland, with the high light-house bearing between N. W. and N., or beyond that distance when it bears N. W. by N., on which bearing it will appear in one with a dark patch on the cliff. On the French coast vessels should not anchor with the two wind-mills of Coquelles, on the high ground between Calais and Sangatte, bearing between S. E. by S. and S. by E.

The Goodwin Sands are extensive and dangerous banks lying off the coast between the North and South Forelands. They are, however, well lighted and buoyed, and may be fearlessly approached in fine weather. Along their eastern and northern edges large patches uncover with the tide, forming considerable tracts of level and firm ground. When

covered, the sands are carried about by the tides, which at times considerably alter the forms of the different shoals, but without greatly changing their general outline. The northern and largest part of the shoal, called the North Goodwin, has on its southwest side a deep inlet named Trinity Bay. The Bunt and Fork lie on the northwest side, and the North Calliper on the southeast side, of the entrance to this inlet. The South Goodwin and South Calliper extend to the southwestward from the southern part of the North Goodwin. The Goodwin Sands are separated from the Brake Sand, and other in-shore shoals, by the Gull Stream.

South Sand Head
light-vessel.

The South Sand Head light-vessel, in 13 fathoms, $\frac{3}{4}$ mile from the southwestern extremity of the Goodwin Sands, exhibits, at an elevation of 38 feet above the sea, a fixed bright light, which should be visible in clear weather from a distance of 10 miles. She is painted red, with the name "South Sand Head" on her sides, and has one mast, with a ball at mast-head. During fogs a gong is sounded, and a gun is fired if a vessel is seen standing into danger. From the light-vessel South Foreland high light-house bears W. $\frac{1}{4}$ S. $3\frac{3}{4}$ miles; Gull light-vessel, N. N. E. 6 miles; and Walmer Castle N. N. W. $\frac{1}{2}$ W. $3\frac{1}{2}$ miles. Ripple mill over Kingsdown church, N. W. $\frac{1}{2}$ W., leads close to the northward of the light-vessel, and $\frac{3}{8}$ mile southward of the South Sand Head; and Upper Deal mill in line with Walmer Castle, N. W. $\frac{3}{4}$ N., leads midway between them.

North Sand Head
light-vessel.

The Goodwin or North Sand Head light-vessel is moored in 10 fathoms, about a mile eastward of the northern extremity of Goodwin Knoll, and exhibits three fixed lights, on separate masts; those on the fore and mizzen 28 feet, and that on the main 42 feet above the sea. They should be visible in clear weather from a distance of 10 miles. The vessel has three masts, with a ball at each mast-head, and is painted red, with the name "Goodwin" on her side. During foggy weather a gong is sounded, and a gun is fired if a vessel is seen standing into danger. From the Goodwin light-vessel the South Foreland high light-house bears S. W. by W. west erly; Ramsgate pier light-house W. N. W.; North Foreland light-house N. W. $\frac{1}{2}$ N. $6\frac{1}{4}$ miles; Kentish Knock light-vessel (with revolving light) N. N. E. $\frac{5}{8}$ E. 21 miles; and Galloper light-vessel (with two fixed lights) N. E. $\frac{1}{4}$ E. 29 miles.

St. Peter's church in line with Broadstairs cliff, N. W. $\frac{1}{4}$ W., leads about $1\frac{1}{2}$ cable-lengths south of the light-vessel, and 6 cable-lengths north of Goodwin Knoll, in 20 feet water. Ramsgate and St. Lawrence churches in line N. W. by W. $\frac{1}{2}$ W., lead about 3 cable-lengths south of the light-vessel, and just clear of the Knoll, in about 30 feet.

The Gull Stream light-vessel is moored in 8 fathoms, about Gull Stream light-vessel. 0.7 mile westward of the western side of the North Goodwin, in the middle of the Gull Stream, and exhibits, at an elevation of 36 feet above the sea, a bright light revolving every 20 seconds, which should be visible in clear weather from a distance of 7 miles. She is painted red, with the name "Gull" on her sides, and has one mast with a ball at the mast-head. During fogs a gong is sounded, and a gun is fired when a vessel is seen standing into danger. From the light-vessel South Foreland high light is on with the south side of Old Stairs Bay, S. W. $\frac{1}{4}$ W.; Ash church is seen one-third of the distance from St. Peter's church toward St. Clement's church at Sandwich, N. W. by W. $\frac{1}{2}$ W.; and Goodwin light-vessel bears E. N. E. $\frac{1}{2}$ E. 5.6 miles.

On the Goodwin Sand, near its eastern side, and between Refuge Beacon. the E. and S. E. Goodwin buoys, is a Refuge Beacon 50 feet high, with a cage at the top, which is reached by steps.

The South Goodwin buoy is a large, conical buoy, check- Goodwin buoys. ered black and white, and surmounted by a staff and cage. It lies in $15\frac{1}{2}$ fathoms, off the southeast part of the S. Calliper, with Ringwold church just open south of the flag-staff of Mr. Curling's house at Kingsdown, W. N. W.; the coast-guard house on Cornhill on with South Foreland low light-house, W. $\frac{1}{4}$ S.; and South Sand Head light-vessel bearing W. $\frac{1}{4}$ S. $2\frac{1}{2}$ miles.

The Southeast Goodwin buoy is a large conical buoy striped black and white vertically, and surmounted by a staff and cage. It lies in 17 fathoms, off the north part of the S. Calliper, with Lord Warden hotel at Dover just touching South Foreland, W. by S.; Northbourne mill on with the Time-Ball at Deal, W. N. W.; and Goodwin beacon bearing N. $\frac{3}{4}$ E. 1.6 miles.

The East Goodwin buoy is a large conical buoy check-ered black and white, and surmounted by a staff and Saint Andrew's cross. It is moored in 19 fathoms, off the southeast part of the North Goodwin, with Goodwin light-vessel

just open west of N. E. Goodwin buoy, N. by E. $\frac{1}{2}$ E.; Upper Deal mill open north of Saint Saviour's church at Deal, W.; the highest part of the north cliff in Saint Margaret Bay in line with Goodwin beacon, W. S. W.; and Gull Stream light-vessel bearing N. W. by W. $\frac{3}{4}$ W. $4\frac{1}{2}$ miles.

The Northeast Goodwin buoy is striped vertically black and white, and lies in 11 fathoms off the northeast part of the North Goodwin, with South Foreland high light-house on with the extremity of the cliff at Saint Margaret Bay, S. W. by W. $\frac{1}{4}$ W.; Upper Deal mill in line with the southwest end of Deal hospital, W. $\frac{3}{4}$ S.; and Goodwin light-vessel bearing N. by E. $\frac{1}{4}$ E. 2 miles.

The Goodwin Knoll buoy is a conical black buoy in 5 fathoms on the western edge of Goodwin Knoll, with Gull Stream light-vessel bearing W. S. W. $4\frac{1}{2}$ miles; North Foreland light N. N. W. $\frac{1}{2}$ W., and North Sand Head light-vessel E. $\frac{1}{2}$ N. $1\frac{1}{2}$ miles.

The Northwest Goodwin buoy is a conical black buoy in 12 fathoms, about 2 cable-lengths from the northwest side of the North Goodwin, with Saint Lawrence mill in line with the obelisk at Ramsgate, N. N. W. $\frac{1}{2}$ W.; Northbourne mill in line with the south end of No. 1 battery, W. $\frac{3}{4}$ S.; and Gull Stream light-vessel bearing W. S. W. 1.8 miles.

The Northwest Bunt buoy is can-shaped and black; it lies in 6 fathoms, with the first mill south of Sandown Castle on with Northbourne mill, W. $\frac{3}{4}$ N.; the north end of the new coast-guard station in Old Stairs Bay touching the chancel end of St. Margaret's church, S. W. by W.; and Gull Stream light-vessel bearing N. by E. $1\frac{1}{4}$ miles.

The Bunt Head buoy is conical and black; it lies in $5\frac{1}{2}$ fathoms at the southwestern extremity of that part of the Goodwin Sands which lies on the northwestern side of Trinity Bay, with Upper Deal mill, its width open south of Saint Saviour's church, W.; Ramsgate pier light-house in line with Saint George's church, Ramsgate, N. $\frac{1}{2}$ E. northerly; Gull Stream light-vessel bearing N. N. E. $\frac{1}{4}$ E. 2.3 miles; and South Sand Head light-vessel S. S. W. 3.7 miles.

Brake Sand. The Brake Sand is about $4\frac{1}{2}$ miles long, N. N. E. and S. S. W., and $\frac{1}{2}$ mile wide, with several shoal patches of 2 to 9 feet.

The South Brake buoy is a spherical buoy, with black and white horizontal stripes, surmounted by a staff and

triangle. It lies in 6 fathoms off the south end of Brake Sand, with North Foreland light-house just open east of Broadstairs north cliff, N. by E. $\frac{3}{4}$ E.; Upper Deal mill on with the Time-Ballmast, W. S. W.; South Sand Head light-vessel bearing S. by W. $\frac{1}{4}$ W. 5 miles; and Gull Stream light-vessel N. E. by E. 1.3 miles.

The Middle Brake buoy is checkered black and white; it lies in 5 fathoms near the eastern edge of Brake Sand, with South Foreland high light bearing S. W. $\frac{1}{4}$ S.; Gull Stream light-vessel S. by E. 1.3 mile; and North Brake buoy N. E. $\frac{3}{4}$ N. $2\frac{1}{2}$ miles.

The North Brake buoy is striped vertically black and white, and lies in 3 fathoms on the northeast part of this shoal, with Saint Lawrence church on with the east cliff at Ramsgate, N. W. $\frac{1}{2}$ W.; North Foreland light-house bearing N. $\frac{1}{4}$ E.; and Ramsgate pier-light N. W. by W.

The North Bar is a small knoll, about 3 miles southeast North Bar. from Ramsgate, with 12 feet water over it. It is marked by a buoy with black and white horizontal stripes, from which St. Clement's church at Sandwich is its own breadth open south of Woodnesborough church, W. $\frac{1}{4}$ S.; St. Lawrence church bears N. W. $\frac{3}{8}$ W.; Goodwin light-vessel, E. S. E. $\frac{3}{4}$ E. $3\frac{3}{4}$ miles; and Gull Stream light-vessel, S. W. by S. 3.1 miles.

Gull Sand is a narrow ridge about a mile long, N. N. E. Gull Sand. and S. S. W., with 3 fathoms water on its shoalest part, which is near the middle. A conical buoy, checkered black and white, lies in 6 fathoms, about $\frac{3}{4}$ mile southeast of it, with St. Lawrence church on with the center of Augusta stairs, Ramsgate, N. W. by W. westerly; South Foreland high-light on with the end of the north cliff of Old Stairs Bay, S. W. $\frac{1}{4}$ W., and nearly in a line with Gull Stream light-vessel; Goodwin light-vessel bearing E. S. E. $\frac{1}{4}$ E. 2.8 miles; and Gull Stream light-vessel S. W. nearly 4 miles.

The Downs, in a general sense, implies the numerous The Downs. banks lying immediately off the coast between the South and North Forelands; and though anchorage may be found anywhere in the channels which separate them, that commonly known by the name is off the town of Deal, between Walmer and Sardown castles, and outside the checkered black and white buoy on Deal Bank. A good berth for large ships is in about 8 fathoms water, over chalky bot-

tom, with Upper Deal church a little open south of Deal castle, W. N. W. $\frac{1}{4}$ W.; Sandwich church just seen north of Sandown castle, N. N. W. $\frac{1}{4}$ W.; and South Foreland high light-house (the low light-house is not seen) in the middle of Old Stairs Bay, S. W. $\frac{1}{4}$ W. It is recommended that men-of-war and merchant-ships of great draught should not anchor north of Upper Deal church in one with Deal castle, and that vessels of about 16 feet draught should select that portion of the Downs to the northward of this mark, near the line of East Bottom telegraph-house on with the highest part of the southern extremity of Old Stairs Bay. When anchored, take a bearing of the South Brake buoy, to facilitate running for the Gull Stream, in case of parting or being obliged to slip. If moored, have open hawse to the southward.

The anchorage in the Small Downs, between Sandown castle and No. 2 battery, and between the south end of the Brake Sand and the shore, is much more secure than that in the Downs, and is recommended for vessels of less than 15 feet draught, as it is more sheltered, with better holding ground and shoaler water; besides which there is less liability to be fouled by drifting ships, and greater facility for running to Ramsgate Harbor in case of necessity.

Deal Bank.

Deal Bank, which must be avoided by vessels standing in-shore, lies $\frac{3}{4}$ mile off the town of Deal, and has 18 feet water on it. A checkered black and white buoy is moored in 4 fathoms off its eastern side, with the south end of Deal hospital on with Upper Deal mill, W. by S.; Woodnesborough church just open of the north end of Deal terrace, N. W. northerly; and South Brake buoy bearing N. E. $\frac{3}{4}$ E. $1\frac{1}{2}$ miles.

Directions.

A vessel bound into the North Sea from abreast the South Foreland may pass south of the South Sand Head light-vessel and east of the Goodwin Sands, or run through the Gull Stream. If intending to take the latter route, round the Foreland at a distance of $\frac{3}{4}$ mile, in 12 to 14 fathoms, and when the South Foreland light-houses are in one, W. by N., and the town of Deal comes open of the cliffs, steer N. E. by N. till Sandown castle bears W. N. W., and then haul a little to the northward to bring South Foreland high light-house over the middle of Old Stairs Bay, about S. W. $\frac{1}{4}$ W. This mark kept on astern will lead between Bunt Head and

South Brake buoys, and in the deepest water up to the Gull Stream light-vessel. After passing the light-vessel close to on either side, keep the same mark on until up with the Gull buoy, or keep the light-vessel bearing S. W. $\frac{1}{2}$ W. until North Foreland light-house bears N. N. W., or the North Sand Head light-vessel E. S. E., when steer to the north-eastward or else haul up N. by E. $\frac{3}{4}$ E. till abreast the Elbow buoy, and then steer N. N. W. for the east buoy of Margate Sand, taking care to allow for a beam tide. These directions must be followed at low-water springs by vessels drawing more than 15 feet, which should pass eastward of the Gull buoy at that time of tide; the Gull light-vessel S. W. $\frac{1}{2}$ W. will lead well clear.

A vessel in the Downs parting her cables, or obliged to slip during a southerly gale and run through the Gull Stream, should endeavor to bring the South Foreland high light-house over the middle of Old Stairs Bay, S. W. $\frac{1}{4}$ W., or if the light-house is not seen, steer to pass about 2 cable-lengths east of the South Brake buoy, then shape a course for the Gull Stream light-vessel, and afterward steer to the northeastward with the light-vessel bearing S. W. $\frac{1}{2}$ W. When North Foreland light-house bears N. N. W., or the North Sand Head light-vessel E. S. E., she may haul out to the eastward and lie to.

In attempting to regain the anchorage by working to windward eastward of the Goodwin Sand, do not when standing toward it bring the North Sand Head light-vessel eastward of N., or come into less than 30 or 28 fathoms until abreast of the Southeast Goodwin buoy, when the light-vessel may be brought as far eastward as N. N. E. When southward of the Goodwin, with South Foreland light-houses in one, W. by N., Upper Deal mill on with Walmer castle N. W. $\frac{3}{4}$ N. will lead midway between the South Sand Head and the light-vessel, or the latter may be passed close to on either side.

A vessel should not attempt to work through the Gull Stream to the southward until half-ebb, or to the northward until half-flood. When working to the southward stand toward Goodwin Knoll, and along the northwest side of the North Goodwin, until the Gull light-vessel comes on with Deal castle, or the outer end of Deal pier, S. W. by W. $\frac{1}{2}$ W.; and toward Gull Sand, and other shoals on the

northwest side of the stream, into 6 or 5 fathoms, or until South Foreland high light-house is in line with the north cliff of Old Stairs Bay. Between North Bar Shoal and the Middle Brake buoy stand toward Brake Sand until South Foreland high light-house appears about midway between Kingsdown and Walmer castle, and in line with the Middle Brake buoy, about S. W. $\frac{1}{2}$ S.; but between the Middle Brake and South Brake buoys stand no nearer than to bring North Foreland light-house twice its breadth open east of Broadstairs north cliff. When standing toward Bunt Head, in the vicinity of the Northwest Bunt buoy, South Foreland high light-house may be brought on with East Bottom semaphore or Gull Stream light-vessel, N. N. E.; but toward Bunt Head buoy large ships should not bring the light-vessel to bear northward of N. N. E. $\frac{1}{2}$ E. Southward of the Bunt Head buoy, or when it is in line with Sandown castle, N. W. $\frac{3}{4}$ W., a vessel may stand toward the Goodwin Sand until South Sand Head light-vessel bears S. W. $\frac{1}{2}$ S. Toward Deal tack when East Bottom semaphore is in one with the south cliff of Old Stairs Bay, or outside the checkered black and white buoy, to avoid Deal Bank.

Life boats.

Life-boats are stationed between the South Foreland and Deal, at Kingsdown and Walmer.

Deal.

The shore from Walmer castle to within a couple of miles of Ramsgate is low, and bordered by a beach of shingle mixed with sand. At Deal a pier runs out 1,100 feet from the esplanade, at the end of which there is a depth of 10 feet at low water. Fresh water can be obtained at the pier.

Light.

A fixed red light is exhibited at the end of the pier.

Tide.

It is high water at Deal, full and change, at 11h. 15m.; springs rise 16 feet, neaps 12 $\frac{1}{2}$ feet.

Life-boat.

A life-boat is stationed at North Deal.

Time-ball.

Greenwich mean time is shown daily to passing vessels by the dropping of a black ball from the mast in the Royal Navy-yard at Deal. The ball is hoisted to half-mast at 5 minutes and close up at 3 minutes before 1 p. m., and is dropped at the instant of 1 p. m. Greenwich mean time. Should any accident prevent the ball from falling at the proper moment, it will be kept at the mast-head ten minutes and then lowered gradually; and will again be raised and dropped by hand at 2 p. m. Greenwich mean time; but

the accuracy of this time cannot be guaranteed within 2 seconds.

Ramsgate Channel extends from the Small Downs to Ramsgate, between Brake Sand and the shore, and has a depth of 12 or 13 feet at low-water springs in its northern part. The only dangers in it are, Cross Ledge with 12 feet water on it, and a flat with 9 feet which extends off shore abreast No. 2 battery. Ramsgate Channel.

The South Fairway buoy is striped vertically red and white, and lies in 17 feet water, on the eastern edge of the shoal flat off No. 2 battery. It is $\frac{1}{2}$ mile from the western side of Brake Sand, and E. N. E. $\frac{3}{4}$ E. $2\frac{3}{4}$ miles from Deal Bank buoy, and should be passed on its eastern side.

The Middle Fairway buoy is checkered red and white, and lies in 15 feet water, N. $\frac{1}{4}$ E. 1.4 miles from the South Fairway buoy, and 0.7 mile from the edge of Brake Sand, with the light-house on the west pier at Ramsgate bearing N. E. by N.

The North Fairway buoy is striped vertically red and white, and lies in 6 feet water, $\frac{1}{4}$ mile from Ramsgate west cliff, with the light-house on the west pier bearing E. N. E. 0.4 mile.

The anchorage off Ramsgate is good with winds between N. W. by W. and N. E. by N.; but with easterly, southerly, or westerly winds, a cross-sea gets up, which, with a strong flood, makes it an uneasy roadstead. Small vessels may anchor with Ramsgate church and light-house in line, and Cliff-end farm on with Cliff-end, in about 15 feet at low-water over chalk-bottom, or farther in-shore according to their draught. Vessels drawing more than 12 feet should anchor in Ramsgate Hole, which is easily found by bringing Minster mills in line with Cliff-end, and Saint Lawrence church just open eastward of the two mills and square tower on the west cliff, in 18 feet, over sand. Ramsgate Road.

Ramsgate Harbor consists of an outer harbor, with an area of 42 acres, inclosed by substantial stone piers extending 437 yards into the sea, and an inner harbor or basin divided from the outer one by a stone wall. The entrance is about 208 feet wide between the pier-heads, with a depth of 20 feet at high and 5 feet at low water springs, and 16 feet at high-water neaps. Close to the eastern pier-end a vessel of 8 feet draught may lie afloat, and go in or out except at low Ramsgate Harbor.

ebbs, but the depths are much influenced by the force and direction of the winds. In the outer harbor are gullies about 140 feet wide, close to the piers, in which vessels are safely moored alongside each other in tiers. The eastern gully is the deepest and widest, having 4 to 5 feet at low water over mud bottom; the western has only 3 feet, with a chalky bottom. The East and West Banks rise in the harbor, drying 6 and 4 feet respectively at low-water springs, and between them is a channel, which dries in spots, leading to the gates of the inner harbor. The East Bank is just awash when the tide-ball is hoisted to indicate 10 feet in the entrance, and being composed of sand and mud, vessels coming in without anchors may run upon it. At the northern end of the eastern gully is a patent slip 450 feet long, capable of receiving two vessels of 300 to 500 tons burden, and 10 to 12 feet draught in ballast, at the same time.

The inner harbor is used by vessels receiving or discharging cargo; it is 1,520 feet long, 350 to 500 feet wide, and carries 10 to 14 feet water. It is entered by single gates, as great dispatch is necessary when vessels are driven in in bad weather; and when there are many vessels in it they are kept afloat by closing the gates, to secure them against injury from grounding on the hard chalky bottom. The eastern entrance is $29\frac{1}{2}$ feet wide, and the western entrance 40 feet; the depth over the sills is 14 feet at high-water springs, and 12 feet at neaps, with northerly winds, but 2 feet less with southerly winds. There is a dry-dock in the inner harbor, 143 feet long, 40 feet wide, and 33 feet wide at entrance, with 11 feet water over the sill at high-water springs, and 8 feet at neaps; but the depth depends on the prevailing wind.

Lights.

On the west pier-head is a circular granite tower, 37 feet high, which exhibits, at an elevation of 38 feet above high water, a fixed red light while there is not less than 10 feet water between the pier-heads, or from $2\frac{3}{4}$ hours before until $3\frac{1}{2}$ hours after high water; when the depth is less than 10 feet the light will be green. This light should be visible in clear weather from a distance of 7 miles.

On the east pier-head is an iron pillar, 12 feet high, showing at an elevation of 25 feet a flashing bright light, which is alternately visible 5 seconds and eclipsed 5 seconds, and which should be seen from a distance of 5 miles, between

the direction of the Dyke buoy and that of the center of the west gate of the inner harbor.

A green light is shown from the west cliff, which in line with the tide-light in the light-house leads in the best water through Old Cudd Channel.

A green light is also shown from the east cliff, which in line with the tide-light leads through Ramsgate Channel from the Middle Fairway buoy.

Two life-boats are stationed at Ramsgate, and in bad Life-boats. weather they are placed on the deck of a steam-tug, so as to be ready for immediate service.

In the day-time a red ball is hoisted on the cliff, near Tide-signal. Jacob's Ladder, when the depth at the entrance exceeds 10 feet.

It is high water at Ramsgate, full and change, at 11h. 44 Tides. m.; ordinary springs rise 13 feet, and neaps 10 feet; but these depths are increased 2 feet with northerly winds. The tides are much influenced by the wind, northerly winds raising the water rapidly on the flood, and keeping it up on the ebb, while southerly winds produce contrary results.

About 2½ hours before high water in the harbor the stream begins to set to the northeast outside the pier-heads, and continues for 5½ hours. About an hour after the 10-foot signal is made, at spring tides, there is 16 feet water between the pier-heads, and at high water, two hours later, there is 20 feet. With neap-tides, the corresponding depths are 12 and 15 feet.

To run for Ramsgate from the Small Downs with a south- Directions. west gale, weigh before the tide has done running to the southward, and steer so as to pass eastward of the South Fairway buoy, and thence for the Middle Fairway buoy, from which Ramsgate light-house, N. E. by N., will lead to the entrance; at night keep the red light on the west pier and the green light on the east cliff in line, on the same bearing. When the buoys are in position they are the best guides for the channel, but a good mark is St. Lawrence church one-quarter of the distance from West Cliff lodge toward Pugin's tower, N. by E., until Ramsgate light-house bears N. E. by N., when alter course for it, always taking care to avoid being carried past the entrance to the eastward. The best time to enter, if not drawing more than 10 feet, is two hours before high water, or when the tide begins to set to the

northeast outside the pier-heads. Pass close to the west pier-head, taking care to keep the large white diamond mark on the landing platform in full view until within the entrance. If, when approaching the entrance, the tide is setting to the northeastward, keep good sail on and close the North Fairway buoy, and steer for the west pier-head—the vessel cannot be too close—and, if there is not time to run out a warp to one of the buoys within the harbor, throw all aback and let go the anchor; if without an anchor run on the East Bank directly toward the pier-house. Several vessels have narrowly escaped destruction by running for the harbor under insufficient sail to give them proper steerage-way, and by keeping too far from the North Fairway buoy, thus crossing the stream of tide instead of coming to the entrance before it.

In working through Ramsgate Channel from the Small Downs, stand toward the shore by the lead, keeping a good lookout for St. Lawrence church coming on with West Cliff lodge, which is a good mark for going about when approaching the flats off No. 2 battery; tack toward the southwest part of the Brake when the water deepens to $4\frac{1}{2}$ or 5 fathoms, as that part of the sand is steep; but when so far up as to bring Sandwich churches W. by N., go about when the North Foreland light-house comes on with Dumpton Point; and as there is good reason to believe that this part of the Brake increases to the westward, a good lookout should be kept for the ripple, without trusting too much to the marks. To clear the western edge of the Cross Ledge, tack when the tide flag-staff is just seen eastward of Ramsgate church; but when the tide-ball is hoisted there is 14 feet water over it. As there are no good clearing-marks for the west side of the Brake Sand, no one should attempt to work through without local knowledge, for although it is generally marked by a ripple, this should not be too much relied on.

At night vessels should not attempt to run for Ramsgate except in case of extreme necessity, when they should know their exact position before dark, with the bearing and distance of the South Fairway buoy, and should carefully note the time when the 10-foot-water signal is made. If compelled, however, to run for Ramsgate from the Small Downs, shape a course for the South Fairway buoy, and when abreast of it, with the Gull Stream light-vessel bearing about

S. E. by E., steer for the Middle Fairway buoy, and when the green lights on the east cliff and the east pier are in line, N. N. E. $\frac{1}{2}$ E., steer for them or borrow to the westward so as to bring the tide-light on the west pier in line with the green light on the east cliff, N. E. by N.; either will lead toward the entrance. If the tide is running to the eastward, take care not to bring the light to the northward of N. E. by N. till the vessel almost touches the pier-head, to avoid being set to the eastward past the entrance.

Between the north part of Brake Sand and the Quern is <sup>Cliff-end Chan-
nel.</sup> Cliff-end Channel with a depth of 8 or 9 feet at low water; but as the tide sets across it, and it is not buoyed, it should not be attempted by strangers.

Between the Quern and the Dike is a narrow passage, <sup>Old Cudd Chan-
nel.</sup> Old Cudd Channel, with a depth of 8 feet at low-water springs, called Old Cudd Channel. It is navigated without difficulty, as a checkered black and white buoy marks the north end of the Quern, and a black buoy the south end of the Dike. To approach it from the westward, bring Mr. Pugin's house, (which stands on the west cliff and has a square tower,) its apparent breadth open south of the pier, N. W. by W. $\frac{1}{4}$ W.; steer between the buoys with this mark on, and then W. by S.; when Ramsgate comes on with the end of the chalk cliff the shallows will have been passed, and a course may be steered for the harbor.

At night the green light on the west cliff in line with the green (or red) tide-light leads through, but this channel cannot be recommended to sailing-vessels at night with an ebb tide, for when the western tide makes, at half ebb, it shoots obliquely across on to the outer shoal, and if a vessel is not quick with her helm she will be set on shore.

The extensive shoal-patches lying off the town of Broad-<sup>Broadstairs
Knolls.</sup> Broadstairs stairs, called the Broadstairs Knolls, have 9 to 20 feet water on them, and their outer edge is marked by a checkered black and white buoy in $3\frac{1}{4}$ fathoms, $1\frac{1}{2}$ miles off shore, with St. George's church at Ramsgate the apparent width of its tower open south of Hearson mill, W. $\frac{1}{2}$ S.; St. Peter's church-tower in line with the north side of the house on the end of the north cliff at Broadstairs, N. W. $\frac{3}{4}$ W.; North Brake buoy bearing S. S. W. $\frac{1}{2}$ W. 1.9 miles, and Elbow buoy E. N. E. $\frac{1}{4}$ E. 1.3 miles.

The Elbow.

The Elbow is a small shoal a couple of miles off shore, with 18 feet water over it; a conical buoy with black and white vertical stripes, surmounted by a staff and cage, lies in 5 fathoms close to its southeastern edge, with St. Lawrence church-tower open north of Dumpton Point, W. $\frac{1}{2}$ S.; North Foreland light-house bearing N. W. by W. $2\frac{1}{2}$ miles; Gull buoy S. by W. $\frac{1}{4}$ W. $2\frac{1}{2}$ miles; and the east buoy of Margate Sand N. by W. $\frac{1}{4}$ W. $5\frac{1}{2}$ miles.

As there are several patches with 16 to 18 feet water between this shoal and the shore, the passage inside it should not be attempted except by those well acquainted with its navigation.

Broadstairs.

Broadstairs, a small watering place, about 2 miles north-east of Ramsgate, has a small harbor formed by a pier which extends from the northern side of a cove. There is 16 feet water at the pier-end at high-water springs, and 10 feet at neaps; but the harbor dries out at low water. The entrance faces the southwest, and is much exposed to the sea driven in by easterly winds. There is anchorage off the harbor in 20 feet at low water, with the light-house on the west pier at Ramsgate just open off the north cliff of Ramsgate, S. W. by W.; and Water tower in line with the coast-guard station on the north cliff of Broadstairs, N. W. by W. $\frac{1}{4}$ W.

Two life-boats are stationed at Broadstairs.

North Foreland.

The coast rises southward of Ramsgate, and continues elevated round the North Foreland, which is a promontory of nearly perpendicular chalk-cliffs, 60 to 120 feet high. It is rendered more conspicuous by the light-house, $\frac{1}{2}$ mile northward off which is Moro Castle, a castellated building of flint, standing close to the edge of the cliff on the southern point of Kingsgate Bay; and $\frac{1}{2}$ mile northward of the latter is Neptune tower, with a wide basement surrounding it.

Light-house.

On the North Foreland, about 300 yards from the edge of the cliff, is an octagonal white tower, 85 feet high, which exhibits, at an elevation of 188 feet above high water, a fixed bright light, which should be visible in clear weather from a distance of 19 miles. The light shows red when bearing between S. by E. $\frac{1}{4}$ E., and S. by W. westerly, the latter limit passing a cable-length eastward of the East Margate buoy.

Life-boat.

A life-boat is stationed at Kingsgate.

TABLE SHOWING THE MAGNETIC DIRECTION AND RATE
OF TIDAL STREAMS IN THE ENGLISH CHANNEL AT
EVERY HOUR OF THE TIDE AT DOVER.

The time of high water at *Dover* is taken as the standard, so that whenever either the time of the turn or the direction of the stream is required to be known, the time of the ship, corrected for the longitude of *Dover*, is to be compared with the time of high water for the day at *Dover*, and the interval sought in the following table, and in the column answering to the ship's position will be found the information required.

In this table it has been necessary to class the information under heads answering to the various compartments of the Channel, for the courses of the stream in the mixed tides are so changeable that a very different stream will be found running at a place but little removed from another in the same portion of the Channel. The seaman must therefore look in which compartment, according to his latitude and longitude his ship is sailing, and in which quarter of that compartment, whether N. E., N. W., S. E., or S. W., and then enter the table for the direction, of the stream.

The 1st compartment comprises the approach to the English Channel *westward of a line joining Ouessant and Scilly*.

The 2d compartment comprises a space eastward of the before-mentioned line from Ouessant to Scilly, and as far as a *line joining the Start and the Casquets*. In this part of the Channel there is a mixed tide, partaking of the joint directions of the Channel and offing streams.

The 3d compartment is bounded on the west by the line joining the Casquets and the Start, and on the east by a line from *Beachy Head to Dieppe*, having the Baie de la Seine on the south. As soon as a vessel passes to the eastward of the Start and Casquets she gets into the true Channel stream which sets straight up and down Channel in the fairway, and will always carry a vessel *toward Beachy Head* while the water is *rising at Dover*, and *from it* while it is *falling there*.

The 4th compartment comprises the Gulf of St. Malo, an estuary which from its magnitude and large tides exercises a powerful influence over the navigation of that part of the Channel in its immediate vicinity; and the seaman must be especially on his guard when drawing near this locality. With the *falling water* at *Dover* the stream sets sharply *into this gulf* on both sides, which the prevalence of westerly winds is said to increase, and with the *rising water* at *Dover* it sets *across and out of the gulf*, the northeastern part of the stream sweeping round the Casquets toward Alderney, and through the Russel and other channels about

Guernsey toward the race of Alderney. A return of the vessels wrecked on the Channel Islands shows that the greater part of them came ashore about the end of the falling water at Dover.

The 5th compartment contains the great bight on the south side of the Channel eastward of Cape Barfleur, known as the Baie de la Seine. With the *rising water* at Dover the stream sets sharply round Cape Barfleur *into the bay*, curving more and more as the depth of the bay is gained, until it finally takes the sweep of the shore. With the flood-tide the western half of the bay is partly in eddy, and the tide slacks in all that part nearly an hour before high water at Dover, while in the eastern half of the bay it runs about half an hour longer than at Dover, so that here a ship beating up Channel toward the end of a rising tide at Dover may prolong the tide in her favor by standing close over to the French coast eastward of Havre. On approaching Boulogne, however, at the beginning of a *rising tide* great attention should be paid to the direction as given in the table, for the streams hereabout meet and are turned down upon the French coast, so that a ship which on the English side would at this time have a stream setting straight up Channel, here encounters one upon her beam, sweeping her down toward the Somme, and hence probably the cause of some of the many disastrous losses which have occurred in this part of the Channel.

The 6th compartment is between Beachy Head and the North Foreland, and the Somme and Dunkerque. In this space the streams from the Channel and North Sea *meet* while the water is *rising* at Dover, and *separate* while it is *falling* there. The point of union and separation is not, however, stationary, but moves from west to east both on the rising and falling water. The place of *meeting* begins off Beachy Head at *five hours before* high water on the *same spot* as that of the *separation* at *one hour after* high water; the place of *four hours before* high water is nearly the same as that of the separation at *two hours after*, and so on nearly with the subsequent hours. For instance, an hour after high water at Dover the separation begins off Beachy Head; in two hours it has reached Hastings, in three hours Rye, and so it creeps on until at low water it has gained the line extending from the North Foreland to Dunkerque. At this time the offing streams on both sides have ceased, and it is slack water all over the North Sea and English Channel as far as the true tide extends; but the stream does not at this time cease in the intermediate tide. When the water at Dover begins to rise the stream on either side sets *toward Dover*, and that from the North Sea consequently *goes with the intermediate* tide, which had not yet ceased running to the westward, while the other, the Channel stream, *opposes* it, and this opposition continues throughout the rising tide at Dover; the

point of meeting gradually shifting its position eastward as the tide advances on the shore. About the time when the water at Dover has done rising, the line of meeting has reached the North Foreland, and the streams on either side are now slack, leaving the intermediate stream running alone as before to the eastward. The next hour finds the offing streams made in the Channel and North Sea, so that now the intermediate stream falls in with the North Sea stream and goes with it, while on the west it separates from the Channel stream, splitting at the same point, Beachy Head, as before.

COMPARTMENT I.
Westward of a line joining Onessant and the Land's End.

Hours.	North side of latitude 49.00 N.					Remarks.	South side of 49.00 N.	
	West part.	Rate.	Near Scilly.	Rate.	Seven Stones.		West part.	Rate.
After high water, Dover.....	W. N. W. $\frac{1}{2}$ W.	Greatest rate, springs, 1.50 knots.	N. N. W. $\frac{1}{2}$ W.	Greatest rate, springs, 1.50 knots.	N. $\frac{1}{2}$ W. $\frac{1}{2}$ E.		W. $\frac{1}{2}$ S.	Greatest rate, springs, 1.50 knots.
	N. $\frac{1}{2}$ W.		N. by E. $\frac{1}{2}$ E.		N. by E. $\frac{1}{2}$ E.		N. by W. $\frac{1}{2}$ W.	
	E. N. E.		N. by E. $\frac{1}{2}$ E.		N. E. $\frac{1}{2}$ N.		E. N. E.	
	E. N. E.		N. E. $\frac{1}{2}$ E.		N. E. $\frac{1}{2}$ E.		N. E. by E. $\frac{1}{2}$ E.	
	S. E. by E. $\frac{1}{2}$ E.		East.		E. N. E.		Turning.	
Before high water, Dover.....	S. $\frac{1}{2}$ E.		S. $\frac{1}{2}$ E.		S. $\frac{1}{2}$ W.		Draining.	
	S. S. W. $\frac{1}{2}$ W.		S. W. $\frac{1}{2}$ W.		S. S. W. $\frac{1}{2}$ W.		S. W. $\frac{1}{2}$ W.	
	S. W. $\frac{1}{2}$ W.		S. W. $\frac{1}{2}$ W.		S. S. W. $\frac{1}{2}$ W.		S. W. $\frac{1}{2}$ S.	
	W. S. W.		S. W. $\frac{1}{2}$ W.		S. W. by W. $\frac{1}{2}$ W.		S. W. by W.	

COMPARTMENT II.

Between { A line joining the Land's End and Onessant,
" " the Casquets and Start, and
" " the Casquets and Sept lies.

Hours.	North side of the Channel.					Remarks.	South side of the Channel.				
	West part.	Rate.	Center.	Rate.	East part.		West part.	Rate.	Center.	Rate.	East part.
After high water, Dover. ver.	W. by N.	Greatest rate, springs, 2.00 knots.	W. $\frac{1}{2}$ N.	Greatest rate, springs, 1.50 knots.	W. $\frac{1}{2}$ N.	{ W. $\frac{1}{2}$ S. near Hurd's Deep. }	W. $\frac{1}{2}$ S.	Greatest rate, springs, 1.50 knots.	W. $\frac{1}{2}$ N.	Greatest rate, springs, 2.10 knots.	W. $\frac{1}{2}$ S.
	Turning.		W. N. W.		West.		Slack.		W. $\frac{1}{2}$ S.		W. S. by W. $\frac{1}{2}$ W.
	North.		W. $\frac{1}{2}$ N.		W. $\frac{1}{2}$ S.		E. $\frac{1}{2}$ N.		Slack.		S. W. by W. $\frac{1}{2}$ W.
	E. $\frac{1}{2}$ S.		Slack.		S. $\frac{1}{2}$ W.		E. N. E. $\frac{1}{2}$ E.		E. $\frac{1}{2}$ S.		S. E. $\frac{1}{2}$ S.
	E. $\frac{1}{2}$ N.		E. $\frac{1}{2}$ S.		S. E. $\frac{1}{2}$ E.		E. N. E. $\frac{1}{2}$ E.		E. $\frac{1}{2}$ S.		S. E. by E. $\frac{1}{2}$ E.
Before high water, Dover.	E. S. E. $\frac{1}{2}$ E.		E. $\frac{1}{2}$ S.		E. S. E. $\frac{1}{2}$ E.		E. N. E. $\frac{1}{2}$ E.		S. E. by E. $\frac{1}{2}$ E.		E. S. E. $\frac{1}{2}$ E.
	E. S. E. $\frac{1}{2}$ E.		E. $\frac{1}{2}$ S.		E. $\frac{1}{2}$ S.		East.		Slack.		E. $\frac{1}{2}$ S.
	Slack.		E. by S.		E. $\frac{1}{2}$ S.		N. E. by E. $\frac{1}{2}$ E.		W. N. W. $\frac{1}{2}$ W.		N. $\frac{1}{2}$ W.
	Turning.		Slack.		Turning.		S. W. by W.		Slack.		W. by N.
	W. $\frac{1}{2}$ N.		West.		W. S. W.		S. W. $\frac{1}{2}$ W.		W. $\frac{1}{2}$ N.		N. W. $\frac{1}{2}$ W.

The courses in this table are magnetic.

COMPARTMENT III.

Between { A line joining Start and Casquets, and
Point Ailly and Beachy Head.

Hours.	West part.	Center.	East part.	Remarks.	Over Hurd's Deep.	Off Cape Barfleur.	Rate.
1	W. + N.	W. by N.	Turning.		W. + S.	N. W. + W.	Greatest rate, springs, 5 to 7 knots.
2	W. N. W. + W.	W. N. W.	W. N. W. + W.		W. + S.	N. W. + W.	Greatest rate, ebb, 2 to 4 knots.
3	W. + N.	W. N. W.	W. by N.		W. by S.	N. W. + W.	
4	W. + S.	W. N. W. + W.	W. + N.		S. W. by W. + W.	N. W. + W.	
5	N. N. E.	W. N. W. + W.	W. + N.		Slack.	N. W. + W.	
6	East.	E. S. E. + E.	E. S. E. + E.		East.	S. E. + E.	
7	E. S. E. + E.	E. S. E.	E. S. E. + E.		E. + S.	S. E. + E.	
8	E. S. E. + E.	E. S. E.	E. S. E. + E.		East.	S. E. + E.	
9	E. S. E. + E.	E. S. E.	E. S. E. + E.		E. + N.	S. E. + E.	
10	E. S. E. + E.	E. S. E. + E.	E. + S.		N. E. by E. + E.	S. E. + E.	

COMPARTMENT IV.

Entrance of Gulf of St. Malo on a line joining Brehat Island and S. W. line of Guernsey Island.

Hours.	12 miles from Brehat Island.	12 miles from Guernsey Island.	Near S. W. point, Guernsey Island.	4 miles W. by S. from Casquets.	4 miles W. N. W. of Cape La Hague.
	Course.	Course.	Course.	Course.	Course.
	Rate.	Rate.	Rate.	Rate.	Rate.
1	N. W. by W. + W.	W. + N.	W. + N.	W. by S.	S. W. by W. + W.
2	S. + W.	South.	S. S. W.	S. W.	S. W. by W. + W.
3	S. + W.	S. E. by S.	S. E. by E. + E.	S. by E. + E.	S. W. by W. + W.
4	S. E.	S. E. by E.	S. E. by E. + E.	S. E. + E.	S. W. + S.
5	S. E.	S. E.	S. E. by E. + E.	S. E. + E.	S. W. + S.
6	S. E. + S.	S. E. by E. + E.	S. E. by E. + E.	S. E. + E.	N. E. by E. + E.
7	S. E. + E.	S. E. by E. + E.	S. E. by E. + E.	N. E. + N.	N. E. by E. + E.
8	N. W. by W. + W.	N. W. + N.	N. N. W.	N. E. + N.	N. E. + N.
9	N. W. + W.	N. W. + N.	N. N. W.	N. E. by E.	N. E. + N.
10	N. W. by W.	W. N. W. + W.	N. N. W.	N. W. + W.	N. E. + N.

The courses in this table are magnetic.

COMPARTMENT I.
Westward of a line joining Onessant and the Land's End.

Hours.	North side of latitude 49.00 N.					Remarks.	South side of 49.00 N.	
	West part.	Rate.	Near Scilly.	Rate.	Seven Stones.		West part.	Rate.
After high water, Dover.....	1 W. N. W. ½ W.	1.50 knots. Greatest rate, springs.	N. N. W. ½ W.	1.50 knots. Greatest rate, springs.	N. ½ W.		W. ½ S.	1.50 knots. Greatest rate, springs.
	2 N. ½ W.		N. by E. ½ E.		N. by E. ½ E.		N. by W. ½ W.	
	3 E. N. E.		N. by E. ½ E.		N. E. ½ N.		E. N. E.	
	4 E. N. E.		N. E. ½ E.		N. E. ½ E.		E. N. E.	
	5 E. ½ S.		East.		E. N. E.		N. E. by E. ½ E.	
	6 S. E. by E. ½ E.		S. ½ E.		S. ½ W.		Turning.	
Before high water, Dover.....	1 S. S. W. ½ W.	1.50 knots. Greatest rate, springs.	S. ½ W.	1.50 knots. Greatest rate, springs.	S. ½ W.		S. by E. ½ E.	
	2 S. S. W. ½ W.		S. W. ½ W.		S. S. W. ½ W.		Doming.	
	3 S. W. ½ W.		S. W. ½ W.		S. S. W. ½ W.		S. W. ½ S.	
	4 W. S. W.		S. W. ½ W.		S. W. by W. ½ W.		S. W. ½ S.	

COMPARTMENT II.

{ A line joining the Land's End and Onessant,
Between " " the Casquets and Start, and
" " the Casquets and Sept Iles.

Hours.	North side of the Channel.					Remarks.	South side of the Channel.				
	West part.	Rate.	Center.	Rate.	East part.		West part.	Rate.	Center.	Rate.	East part.
After high water, Dover. ver.	1 W. by N.	2.00 knots. Greatest rate, springs.	W. ½ N.	1.50 knots. Greatest rate, springs.	W. ½ N.	{ W. ½ S. near Hurd's Deep.	W. ½ S.	1.50 knots. Greatest rate, springs.	W. ½ N.	1.50 knots. Greatest rate, springs.	W. ½ S.
	2 Turning.		W. N. W.		W. ½ S.		Slack.		W. ½ S.		W. S. W. ½ W.
	3 North.		W. ½ N.		W. ½ S.		E. N. E. ½ E.		Slack.		S. W. by W. ½ W.
	4 E. ½ S.		Slack.		S. ½ W.		E. N. E. ½ E.		E. S. E. ½ E.		S. E. by E. ½ E.
	5 E. ½ N.		E. ½ S.		S. E. ½ S.		E. N. E. ½ E.		S. E. ½ S.		S. E. ½ S.
	6 E. ½ S.		E. ½ S.		E. S. E. ½ E.		East.		E. ½ S.		E. S. E. ½ E.
Before high water, Dover.	1 E. S. E. ½ E.	2.00 knots. Greatest rate, springs.	E. by S.	1.50 knots. Greatest rate, springs.	E. ½ S.		N. E. by E. ½ E.	1.50 knots. Greatest rate, springs.	Slack.	1.50 knots. Greatest rate, springs.	E. ½ N.
	2 Slack.		Slack.		E. ½ S.		Slack.		W. N. W. ½ W.		N. ½ W.
	3 Turning.		E. ½ S.		Turning.		S. W. ½ W.		Slack.		N. W. ½ W.
	4 W. ½ N.		West.		W. S. W.		S. W. ½ W.		W. ½ N.		N. W. ½ W.

The courses in this table are magnetic.

COMPARTMENT III.

Between { A line joining Start and Casquets, and
" " Point Ailly and Beachy Head.

Hours.	West part.	Rate.	Center.	Rate.	East part.	Remarks.	Over Hurd's Deep.	Rate.	Off Cape Barreuer.	Rate.
After high water, Dover.....	W. + N.	Greatest Hood 2 30 ebb 2 40 springs, rate, knots.	W. by N.	Greatest Hood 2 30 ebb 2 40 springs, rate, knots.	Turning W. N. W. + W.		W. S.	Greatest Hood 2 15 ebb 2 40 springs, rate, knots.	W. W.	
	W. N. W. + W.		W. N. W. by N.		W. by S.		W. W.			
	W. + S.		W. N. W. + W.		W. by W.		W. W.			
	W. + S.		W. N. W. + W.		W. S. W.		W. W.			
	N. N. E.		W. N. W. + W.		Slack.		W. W.			
	E. East.		E. S. E. + E.		E. + S.		W. W.			
Before high water, Dover.....	E. S. E.	Greatest Hood 2 30 ebb 2 40 springs, rate, knots.	E. S. E. + E.	Greatest Hood 2 30 ebb 2 40 springs, rate, knots.	E. S. E. by S.		N. E. by E.	Greatest Hood 2 15 ebb 2 40 springs, rate, knots.	S. S.	
	E. S. E.		E. S. E.		E. S. E.		S. S.			
	E. S. E.		E. S. E.		E. S. E.		S. S.			
	E. S. E.		E. S. E.		E. S. E.		S. S.			
	E. S. E.		E. S. E.		E. S. E.		S. S.			
	E. S. E.		E. S. E.		E. S. E.		S. S.			

COMPARTMENT IV.

Entrance of Gulf of St. Malo on a line joining Brehat Island and S. W. line of Guernsey Island.

Hours.	12 miles from Brehat Island.		12 miles from Guernsey Island.		Near S. W. point, Guernsey Island.		4 miles W. by S. from Casquets.		4 miles W. N. W. of Cape La Hague.	
	Course.	Rate.	Course.	Rate.	Course.	Rate.	Course.	Rate.	Course.	Rate.
After high water, Dover...	1 N. W. by W. † W.	Greatest rate, springs, uncertain.	W. † N. South. S. † W. S. † by S. S. E. by E. S. E. by E. S. E. by E. † E.	Greatest rate, springs, uncertain.	W. † N. S. S. W. S. E. by E. † E. S. E. by E. † E. S. E. by E. † E. S. E. by E. † E. S. E. by E. † E. N. N. W.	Greatest rate, springs, 5 to 7 knots.	W. by S. S. W. S. by E. † E. S. E. by E. † E. S. E. by E. † E. N. E. by N. N. E. by N. N. E. by N.	Greatest rate, springs, 5 to 7 knots.	S. W. by W. † W. S. W. by W. † W. S. W. by W. † W. N. E. by E. † E. N. E. by E. † E. N. E. by N. N. E. by N.	Greatest rate, springs, 5 to 7 knots.
	2 S. † W.									
	3 S. E.									
	4 S. E. † E.									
	5 S. E. by E.									
	6 S. E. by E.									
Before high water, Dover...	1 N. W. by W. † W.	Greatest rate, springs, uncertain.	W. † N. South. S. † W. S. † by S. S. E. by E. S. E. by E. S. E. by E. † E.	Greatest rate, springs, uncertain.	W. † N. S. S. W. S. E. by E. † E. S. E. by E. † E. S. E. by E. † E. S. E. by E. † E. N. N. W.	Greatest rate, springs, 5 to 7 knots.	W. by S. S. W. S. by E. † E. S. E. by E. † E. S. E. by E. † E. N. E. by N. N. E. by N. N. E. by N.	Greatest rate, springs, 5 to 7 knots.	S. W. by W. † W. S. W. by W. † W. S. W. by W. † W. N. E. by E. † E. N. E. by E. † E. N. E. by N. N. E. by N.	Greatest rate, springs, 5 to 7 knots.
	2 N. W. by W. † W.									
	3 N. W. by W. † W.									
	4 N. W. by W. † W.									
	5 N. W. by W. † W.									
	6 N. W. by W. † W.									

The courses in this table are magnetic,

COMPARTMENT V.
In the Baie de la Seine, south of a line joining Cape Barfleur and Cape Antifer.

Hours.	West part.	Rate.	Center.	Rate.	East part.	Rate.	Remarks.
1	N. W. by N.	ebb 2.70 } knots. Greatest rate, springs, flood 3.20 } knots.	W. N. W.	ebb 3.20 } knots. Greatest rate, springs, flood 3.30 } knots.	W. $\frac{1}{2}$ N.	ebb 3.00 } knots. Greatest rate, springs, flood 3.30 } knots.	
2	N. N. W. $\frac{1}{2}$ W.		W. N. W.		W. by S.		
3	N. N. W. $\frac{1}{2}$ W.		W. N. W.		W. by N.		
4	N. W. by N.		N. W. by W. $\frac{1}{2}$ W.		West.		
5	N. N. W.		N. W. by W. $\frac{1}{2}$ W.		West.		
6	Slack.		N. W. by W. $\frac{1}{2}$ W.		W. $\frac{1}{2}$ S.		
5	S. S. E. $\frac{1}{2}$ E.	ebb 2.70 } knots. Greatest rate, springs, flood 3.20 } knots.	E. S. E.	ebb 3.20 } knots. Greatest rate, springs, flood 3.30 } knots.	W. $\frac{1}{2}$ S.	ebb 3.00 } knots. Greatest rate, springs, flood 3.30 } knots.	
4	S. S. E. $\frac{1}{2}$ E.		E. S. E.		E. N. E.		
3	S. S. E. $\frac{1}{2}$ E.		E. S. E.		E. N. E. $\frac{1}{2}$ E.		
2	S. E. $\frac{1}{2}$ S.		E. S. E.		E. N. E. $\frac{1}{2}$ E.		
1	S. E. $\frac{1}{2}$ S.		E. S. E.		E. N. E. $\frac{1}{2}$ E.		

COMPARTMENT VI.
Between { A line joining Beachy Head and Point Ailly, and
the North Foreland and Dunkerque.

Hours.	Remarks.	West of	East of	Off South Sand Head.	Off North Sand Head.
		Line of separation.		Course.	Rate.
1	{ The tides separate on a line joining— Beachy Head and St. Valéry— Hastings and Treport— Hastings and Cayeux— Folkestone and Calais— South Foreland and Point Gravelines— Ramsgate and Nieuport, passing over North Sand Head, the south line of the Falls, and the banks off Nieuport—	W. $\frac{1}{2}$ N.	N. E. by E.	N. E.	Greatest rate, springs, 3.3 knots.
2		W. $\frac{1}{2}$ N.	N. E. by E.	N. E. $\frac{1}{2}$ E.	
3		West.	N. E. by E. $\frac{1}{2}$ E.	N. E. by E. $\frac{1}{2}$ E.	
4		W. S. W. $\frac{1}{2}$ W.	N. E. by E. $\frac{1}{2}$ E.	N. E. by E. $\frac{1}{2}$ E.	
5		W. S. by W.	N. E. by E. $\frac{1}{2}$ E.	N. E. by E. $\frac{1}{2}$ E.	
6	{ The tides meet on a line joining— Beachy Head and Point Ailly— Bexhill and Cayeux, both streams turn- ing down toward the Somme— The tides meet on a line joining Rye and the Somme, passing over the Basaurille, both tides setting to the Somme— The tides meet on a line joining— Dungeness and Tonquet Point— Do. Dover and Dunkerque nearly—	W. S. W. $\frac{1}{2}$ W.	{ E. $\frac{1}{2}$ N. and northward }	S. W. $\frac{1}{2}$ S.	Greatest rate, springs, 3.3 knots.
		Tides meet.		S. W. $\frac{1}{2}$ S.	
5		E. S. E. $\frac{1}{2}$ E.	S. W. by W.	S. W. $\frac{1}{2}$ S.	
4		S. S. E. $\frac{1}{2}$ E.	S. by W.	S. W. $\frac{1}{2}$ W.	
3		S. E. by E. $\frac{1}{2}$ E.	S. W. $\frac{1}{2}$ W.	W. S. W.	
2		E. N. E. $\frac{1}{2}$ E.	W. S. W. $\frac{1}{2}$ W.	W. $\frac{1}{2}$ N.	S. by W. $\frac{1}{2}$ W. S. by W. $\frac{1}{2}$ W.
1		N. E. by E. $\frac{1}{2}$ E.	S. W. by W. $\frac{1}{2}$ W.	N. by E. $\frac{1}{2}$ E.	

The courses in this table are magnetic.



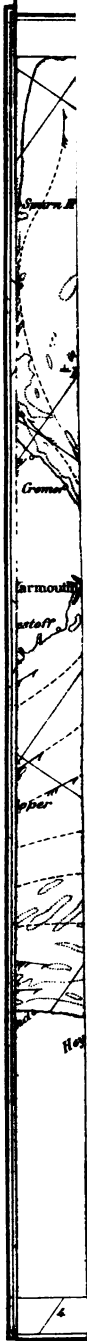
COMPARTMENT V.
In the Bate de la Seine, south of a line joining Cape Barfleur and Cape Antifer.

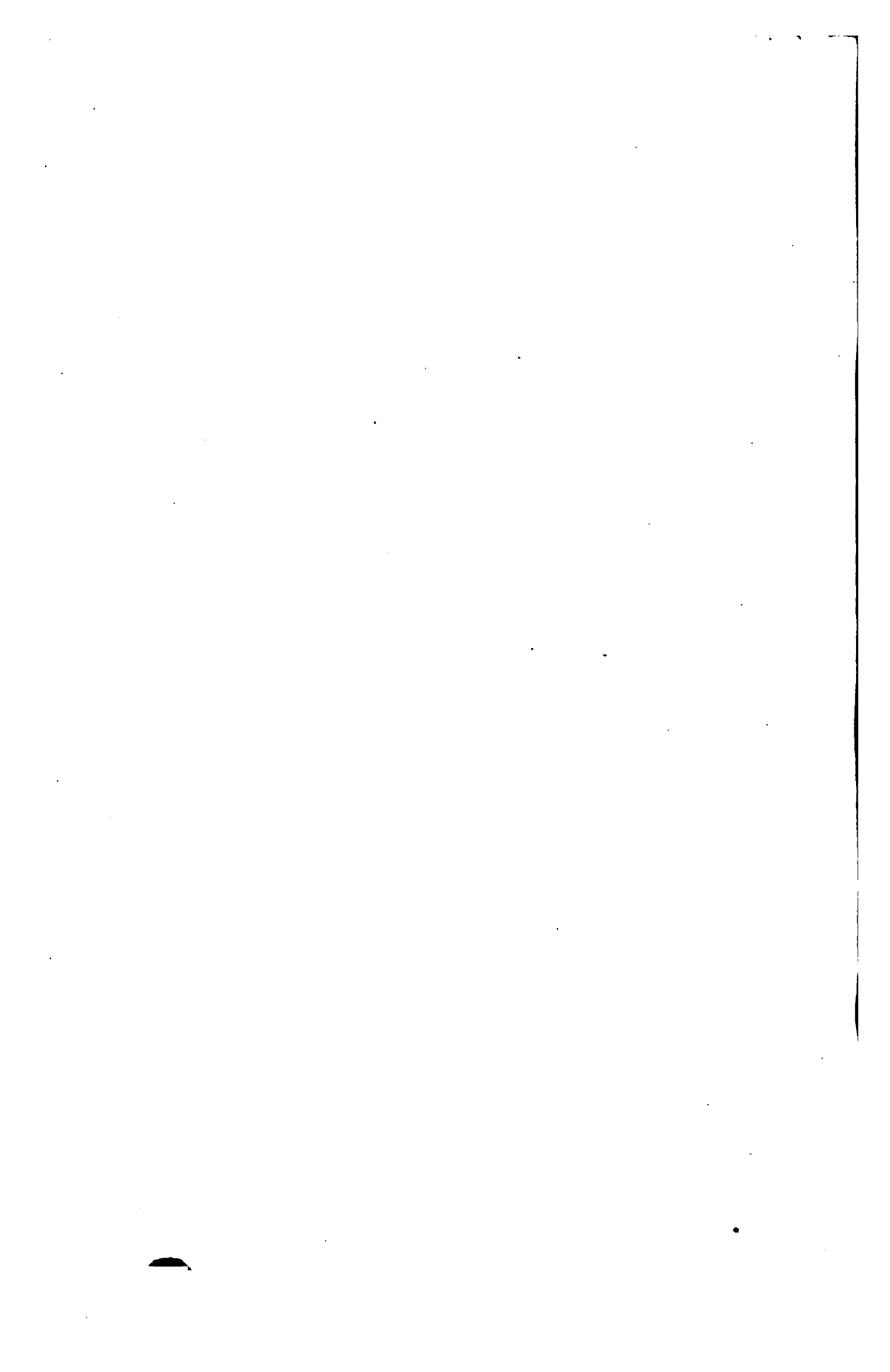
Hours.	West part.	Rate.	Center.	Rate.	East part.	Rate.	Remarks.
1	N. W. by N.	ebb 3.70 } knots rate, springs. Greatest Flood 4.20	W. N. W.	ebb 3.20 } knots rate, springs. Greatest Flood 3.30	W. $\frac{1}{2}$ N.	ebb 3.00 } knots rate, springs. Greatest Flood 3.30	
2	N. N. W. $\frac{1}{2}$ W.		W. N. W.		W. by S.		
3	N. N. W. $\frac{1}{2}$ W.		W. N. W.		W. by N.		
4	N. W. by N.		N. W. by W. $\frac{1}{2}$ W.		West.		
5	N. N. W.		N. W. by W. $\frac{1}{2}$ W.		West.		
6	Slack.		N. W. by W. $\frac{1}{2}$ W.		W. $\frac{1}{2}$ S.		
5	S. S. E. $\frac{1}{2}$ E.	ebb 3.70 } knots rate, springs. Greatest Flood 4.20	S. E.	ebb 3.20 } knots rate, springs. Greatest Flood 3.30	W. $\frac{1}{2}$ S.	ebb 3.00 } knots rate, springs. Greatest Flood 3.30	
4	S. S. E. $\frac{1}{2}$ E.		S. E.		E. N. E.		
3	S. S. E. $\frac{1}{2}$ E.		S. E.		E. N. E. $\frac{1}{2}$ E.		
2	S. E. $\frac{1}{2}$ S.		S. E.		E. N. E. $\frac{1}{2}$ E.		
1	S. E. $\frac{1}{2}$ S.		S. E.		E. N. E. $\frac{1}{2}$ E.		

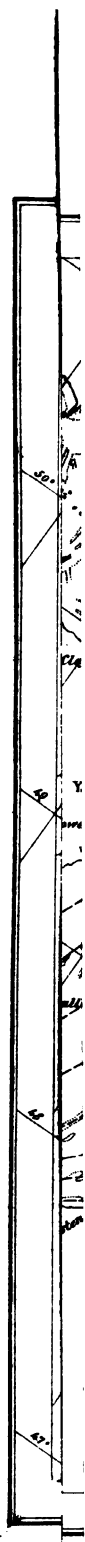
COMPARTMENT VI.
Between { A line joining Beachy Head and Point Ailly, and
the North Foreland and Dunkerque.

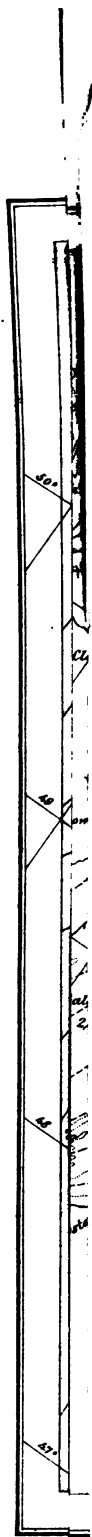
Hours.	Remarks.	West of	Line of separation.	East of	Off South Sand Head.	Off North Sand Head.
					Course.	Rate.
1	{ The tides separate on a line joining— Beachy Head and St. Valéry— Hastings and Treport Hastings and Cayeux Folkestone and Calais South Foreland and Point Gravellines Ramsgate and Nieuport, passing over North Sand Head, the south line of the Falls, and the banks off Nieuport	W. $\frac{1}{2}$ N.	N. E. by E.	N. E. by E.	N. E.	N. by E. $\frac{1}{2}$ E.
2		W. $\frac{1}{2}$ N.	N. E. by E.	N. E. by E.	N. E. $\frac{1}{2}$ E.	N. by E. $\frac{1}{2}$ E.
3		West.	N. E. by E. $\frac{1}{2}$ E.	N. E. by E. $\frac{1}{2}$ E.	N. E. by E. $\frac{1}{2}$ E.	N. E.
4		W. S. W. $\frac{1}{2}$ W.	N. E. by E. $\frac{1}{2}$ E.	N. E. by E. $\frac{1}{2}$ E.	N. E. by E. $\frac{1}{2}$ E.	E. $\frac{1}{2}$ S.
5		S. W. by W.	{ E. $\frac{1}{2}$ N. and northward.	{ E. $\frac{1}{2}$ N. and northward.	S. W. $\frac{1}{2}$ S.	S. by W. $\frac{1}{2}$ W.
6		W. S. W. $\frac{1}{2}$ W.	Tides meet.			
5	{ The tides meet on a line joining— Beachy Head and Point Ailly Bexhill and Cayeux, both streams turn- ing down toward the Somme The tides meet on a line joining Rye and the Somme, passing over the Basaurulle, both tides setting to the Somme The tides meet on a line joining— Dungness and Touquet Point Do. Dover and Dunkerque nearly	E. S. E. $\frac{1}{2}$ E.	S. W. by W.	S. W. by W.	S. W. $\frac{1}{2}$ S.	Greatest rate, springs, 3.3 knots.
4		S. S. E. $\frac{1}{2}$ E.	S. by W.	S. by W.	S. W. $\frac{1}{2}$ W.	
3		S. E. by E. $\frac{1}{2}$ E.	S. W. $\frac{1}{2}$ W.	S. W. $\frac{1}{2}$ W.	W. S. W.	
2		E. N. E. $\frac{1}{2}$ E.	W. S. W. $\frac{1}{2}$ W.	W. S. W. $\frac{1}{2}$ W.	W. $\frac{1}{2}$ N.	S. by W. $\frac{1}{2}$ W.
1		N. E. by E. $\frac{1}{2}$ E.	S. W. by W. $\frac{1}{2}$ W.	S. W. by W. $\frac{1}{2}$ W.	N. by E. $\frac{1}{2}$ E.	S. by W. $\frac{1}{2}$ W.

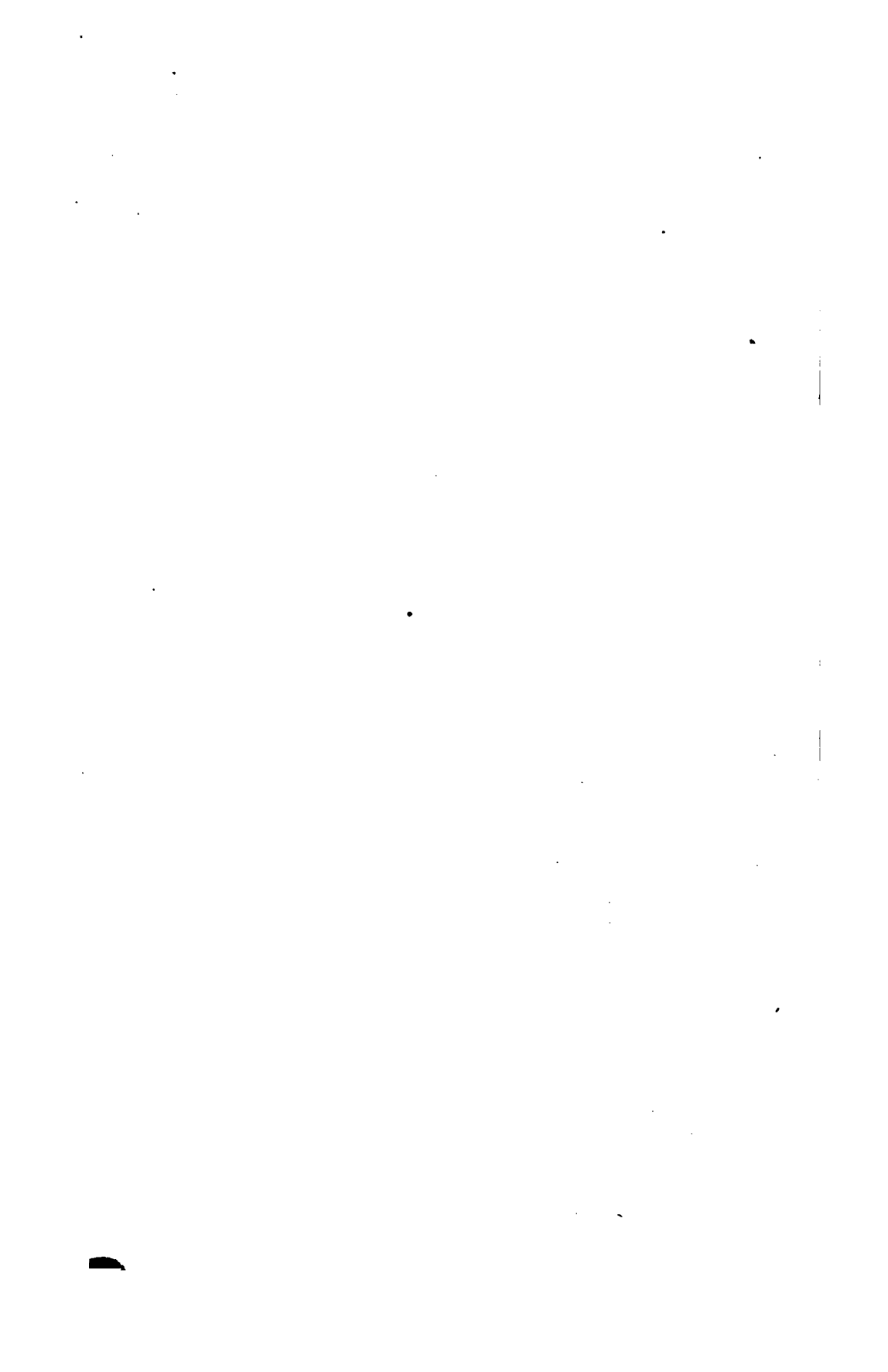
The courses in this table are magnetic.

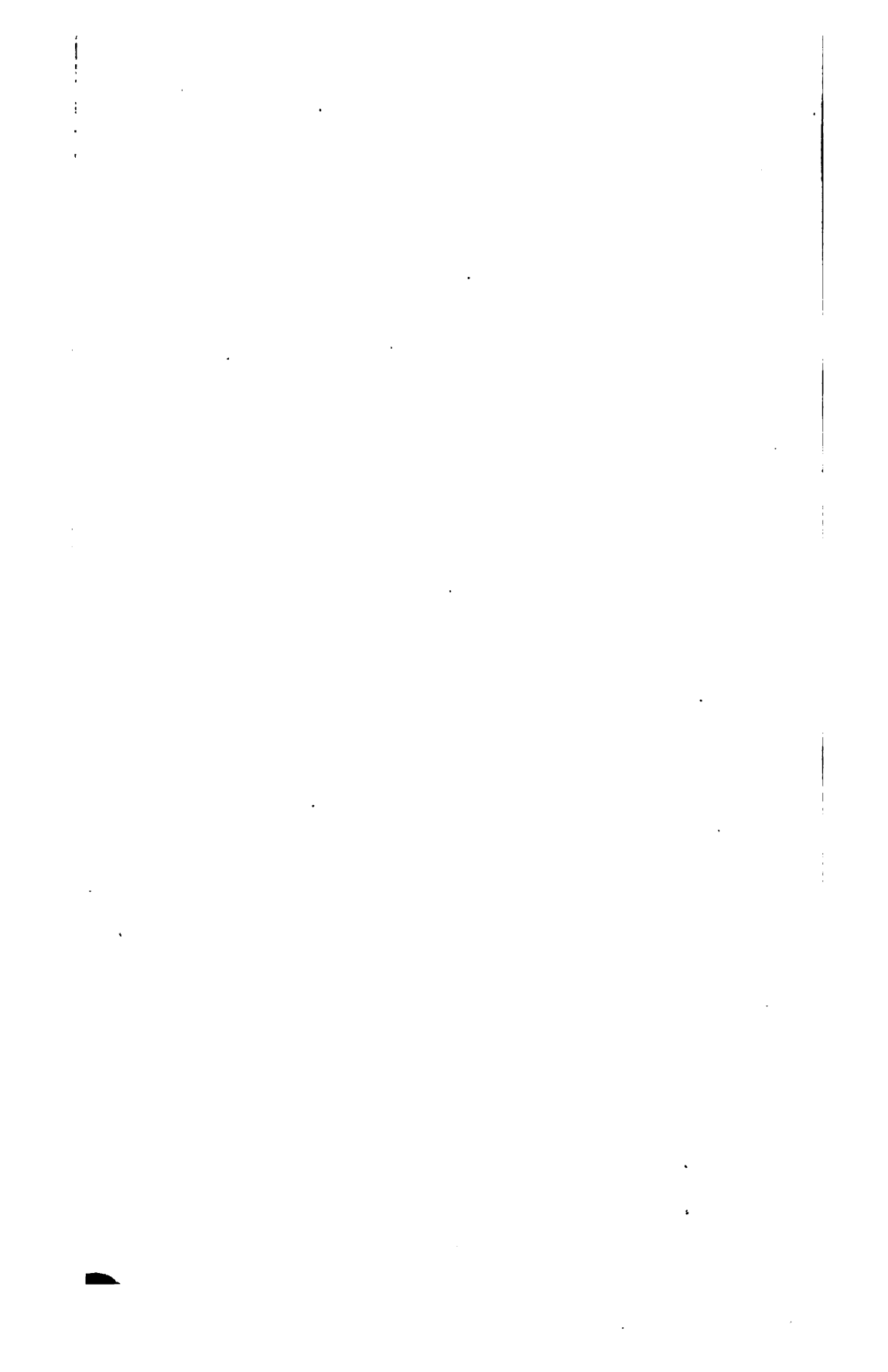




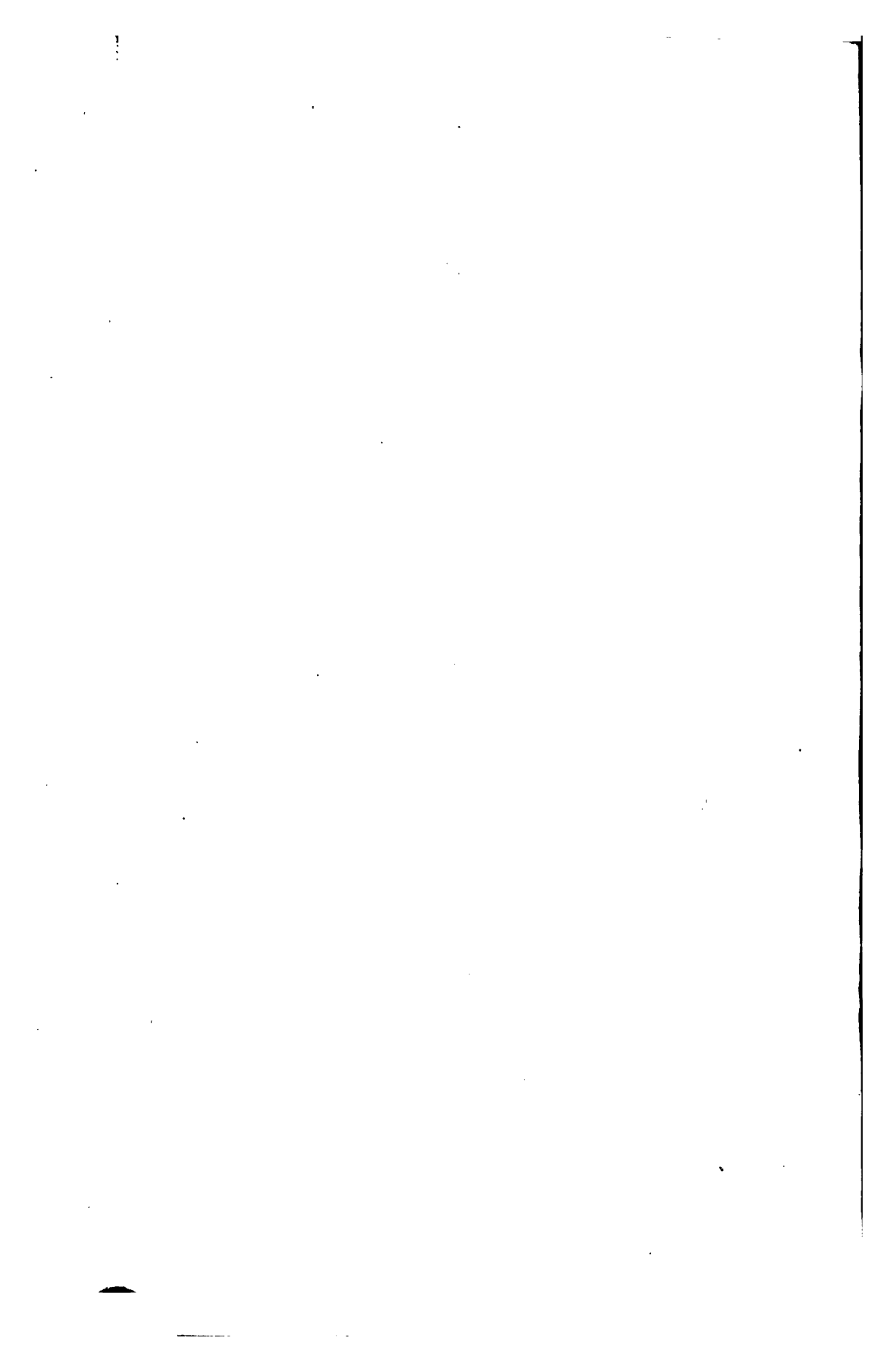












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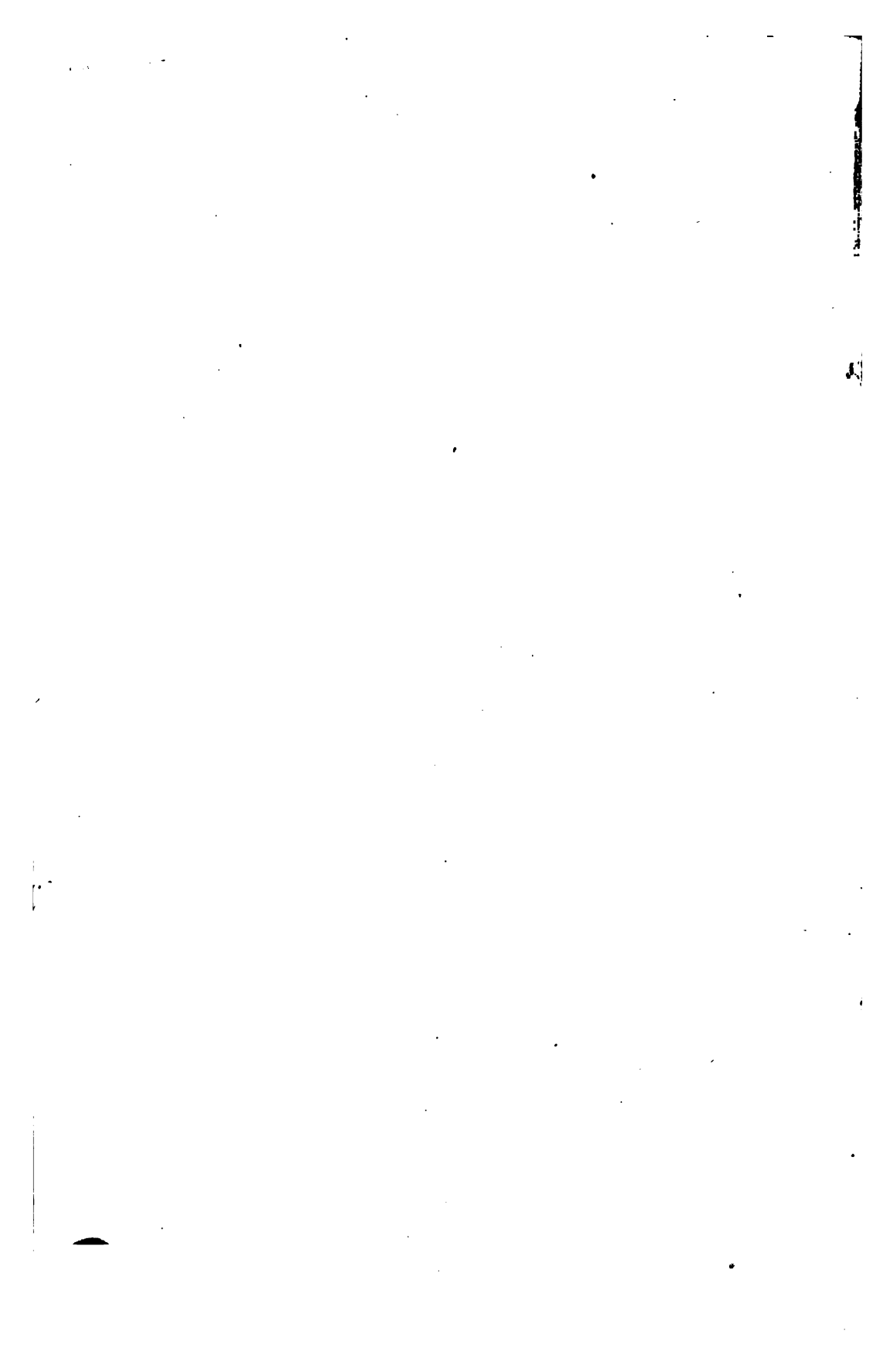
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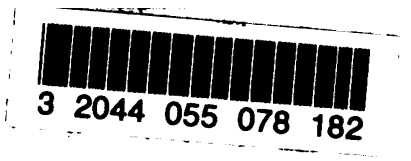
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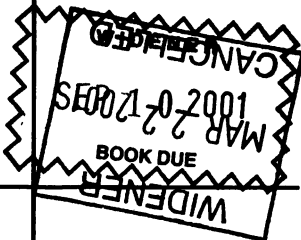


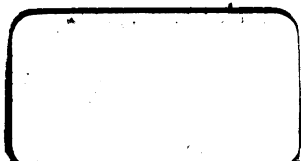


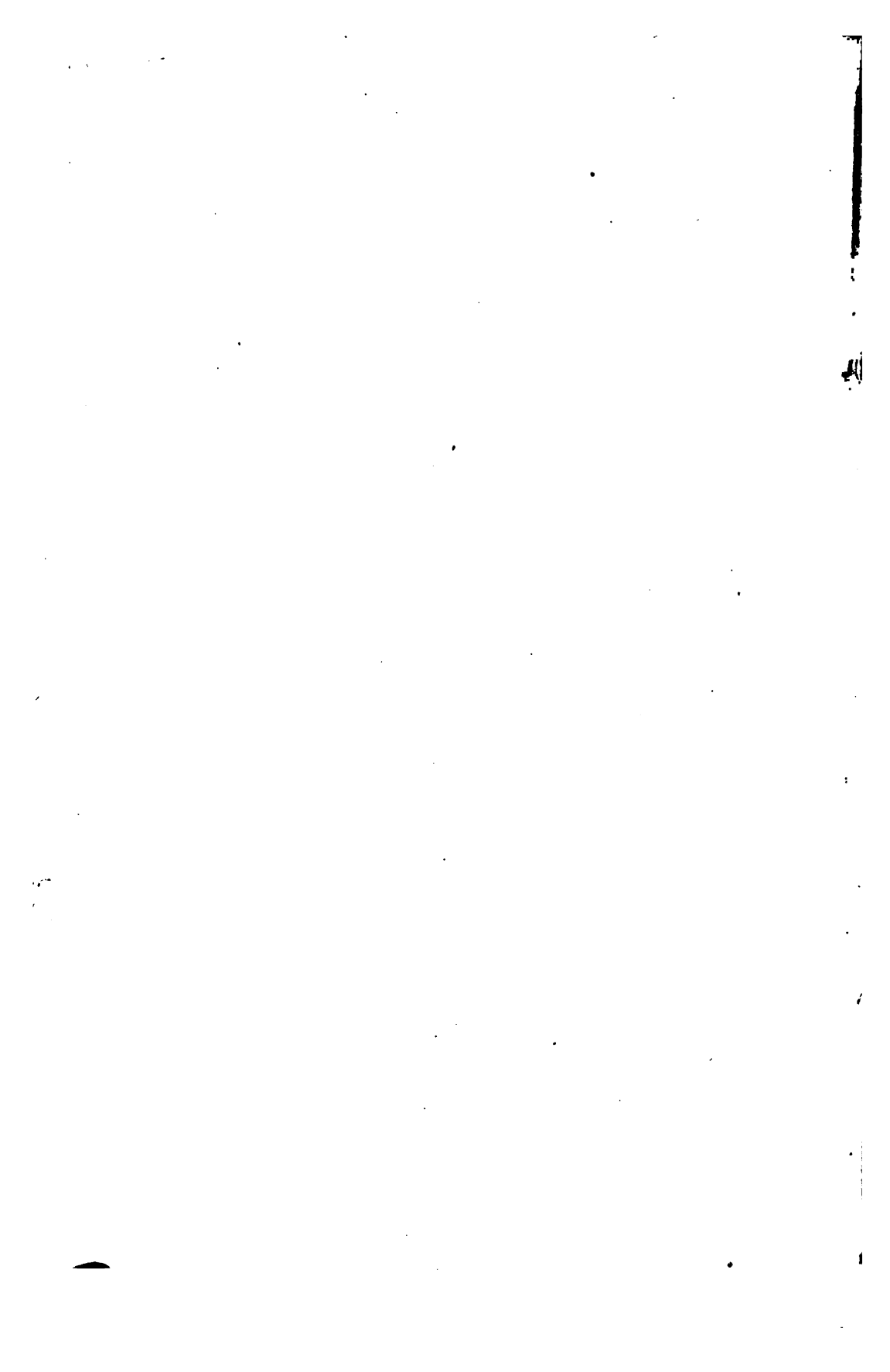


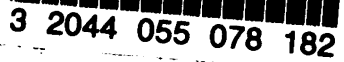
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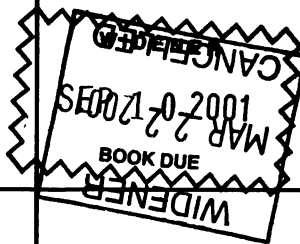
	

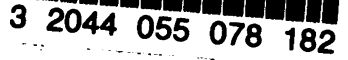




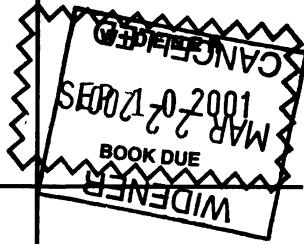


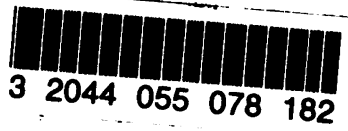
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